COLES ARCHITECTURE
ENGINEERING
PROJECT MANAGEMENT

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SPECIFICATIONS

HOLLAND COLLEGE SUMMERSIDE WATERFRONT CAMPUS
GREENBUILD TRADE EXPANSION
SUMMERSIDE, PE

Consultant:

Coles Associates Ltd.
Charlottetown, PE
Project #261102

Issued for Tender – October 29, 2026

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1 General

PROJECT NAME:

Holland College Summerside Waterfront Campus
Greenbuild Trade Expansion

LOCATION:

98 Water Street, Summerside, PE

OWNER:

Holland College

PRIME CONSULTANT:

Coles Associates Ltd.
201 - 85 Fitzroy Street, Charlottetown, PE

PRIME CONSULTANT PROJECT CONTACT:

Name:	Scott MacNeill, AAPEI, MRAIC
Phone:	902-368-2300
Email:	smacneill@colesassociates.com

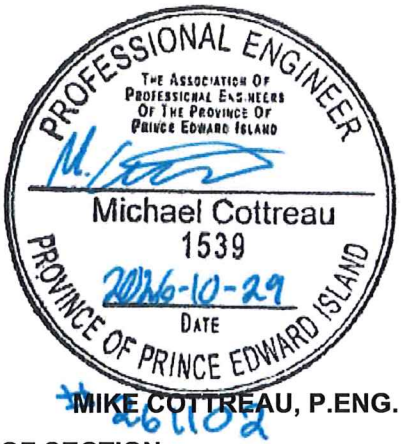
PROFESSIONAL STAMPS:



NAZMI LAWEN, P. ENG. F.E.C.



SCOTT MACNEILL, AAPEI, MRAIC



MIKE COTTREAU, P.ENG.



ELLIOTT COLES, P.ENG., F.E.C.

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1 General

1.1 LIST OF DRAWINGS

.1 A000 Cover Page

CIVIL:

.2 C100 Site Plan
.3 C101 Typical Details & Sections

ARCHITECTURAL:

.4 A001 Context Plan, Project Info, General Notes, Legend and Typical Mounting Heights
.5 A002 Door & Frame Schedule and Window Schedule
.6 A040 Life Safety Plans
.7 A050 Demolition Plans
.8 A100 Floor Plans
.9 A140 Floor Finish Plans
.10 A160 Reflected Ceiling Plans
.11 A250 Enlarged Exterior Elevations
.12 A400 Vertical Circulation
.13 A500 Enlarged Washroom Plan & Interior Elevations

MECHANICAL:

.14 M001 Legends
.15 M010 Plumbing Demolition Plan
.16 M030 Ventilation Demolition Plan
.17 M040 Fire Protection Demolition Plan
.18 M100 Plumbing - Sanitary
.19 M101 Plumbing - Domestic Water
.20 M102 Plumbing - Details
.21 M103 Plumbing - Details & Schedules
.22 M200 Heating - Hydronic Supply & Return
.23 M201 Heating - Geothermal Site plan
.24 M202 Heating - Geothermal PID
.25 M203 Heating - Details
.26 M204 Heating - Schedules
.27 M300 Ventilation - Supply & Return
.28 M301 Ventilation - ERV Outdoor Air & Exhaust
.29 M302 Ventilation - Details & Schedules
.30 M401 Fire Protection Plans

ELECTRICAL:

.31 E001 Legend, Full Building & Site Plan, Existing Freezer Enlargement & Trench Detail
.32 E010 Main Level & Level 2 Demolition - Power, Communications, Systems & Lighting
.33 E100 Main Level & Level 2 - Power, Communications & Systems
.34 E200 Main Level & Level 2 - Lighting
.35 E300 Power, Communications and Systems Details
.36 E301 Lighting Details
.37 E302 Schedules

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1 General

1.1 APPENDICES

.1 **APPENDIX 'A'**
Holland College - Data Wiring Guidelines.

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1 General

1.1 LIST OF SCHEDULES

.1 Material / Finish Schedule
.2 Accessories Schedule

*** All schedules located at the back of these Specifications.**

END OF SECTION

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1 General

1.1 INVITATION - TENDER CALL

.1 The Owner, Holland College is issuing this tender as follows:
- .1 Sealed tenders will be received as per TIMING REQUIREMENTS of this section.
- .2 Tenders are to be clearly marked with the name of the project & the Bidder's name.
- .3 Tenders documents will need to be received at location of tender closing, prior to the time of tender closing noted and on the date specified in the Tender. No submission will be accepted after that time.
- .4 The tender opening will be private.
- .5 Instructions on submitting Tender Bid Form prior to 2:00 PM on date of Tender closing are as follows:
  - .1 Bidders are to email completed Bid Form and required supplementary information, to the attention of Daniel Morris, djmorris@hollandcollege.com, with an email cc: directed to Scott MacNeill at smacneill@colesassociates.com.
    No hard copies will be accepted.
- .6 Refer to Section 01 10 00 - Summary, for full summary of work.

1.2 QUERIES / ADDENDA

.1 Direct all questions during the tender period to:

Coles Associates Ltd.
85 Fitzroy Street, Suite 201
Charlottetown, PEI C1A 1R6
Phone: (902) 368-2300
Email: smacneill@colesassociates.com
Attention: Scott MacNeill, AAPEI, MRAIC
(cc: djmorris@hollandcollege.com & sjavanmard@colesassociates.com.)

.2 Addenda may be issued during the bidding period. All addenda become part of the Contract Documents. Include costs in the Bid Price.

.3 Verbal answers are only binding when confirmed by written addenda.

.4 Clarifications requested by bidders must be in writing not less than four days before tender close. The reply will be in the form of an addendum, a copy of which will be issued two days prior to tender close.

1.3 TENDERING PROCEDURE

.1 General Contractors:
- .1 Submit their tender for the entire work of this Contract, INCLUDING the work of all subcontracts, directly to the Owner in accordance with the requirements of the Invitation to Tender and this specification.

.2 Subcontractors:
- .1 Submit their tenders directly to the General Contract bidders, for incorporation by the General Contractors into their General Contract tenders.

.3 General Contract bidders shall take particular care to ensure that their tender is submitted on the proper tender form.

1.4 SPECIFICATION EXPLANATION

.1 Whenever the words "as shown," "as noted," "as called for," "indicated," or similar phrases are used, they shall be understood to refer to this specification and/or the accompanying drawings and addenda.

.2 The words "provided", "install" or similar words shall mean the work described shall be completely supplied, and erected or installed by the Contractor, unless otherwise noted.
.3 All materials are to be new unless noted otherwise.

1.5 EXAMINATION OF SITE

.1 All bidders submitting tenders for this work shall first examine the site and all conditions thereon and/or therein, including:
  .1 Existing building conditions visually evident at the time of tender upon which the Work of this Contract will be installed.
  .2 Conditions attached to, abut against or in any other way affected by existing conditions.
.2 All tenders shall take into consideration all such conditions as may affect the work under this Contract.
.3 No extra payment will be made to the Contractor, above the Contract Price, for costs resultant from failure to determine the conditions that affect the Work.
.4 A visit to the project site has been arranged for bidders as noted in the timing requirements of this section.

1.6 EXISTING CONDITIONS

.1 If in the performance of the contract, subsurface or latent conditions at the site are found to be materially different from those indicated by the drawings and specifications, or unknown conditions not usually inherent in work of the character shown and specified, the attention of the Consultant shall be called immediately in writing to such conditions before they are disturbed. Upon such notice or resulting from their own observation of such conditions the Consultant shall promptly make such changes in the drawings and specifications as they find necessary to conform to the different conditions and any increase or decrease in the cost shall be adjusted as provided under Changes in the Work.

1.7 DOCUMENT INTERPRETATION

.1 The Consultant's interpretation of Contract Documents shall be final.
.2 Should the Bidder find discrepancies in, or omissions from the drawings, specifications or other tender documents, or be in doubt as to their meaning or interpretation, the Bidder should at once notify the Consultant in writing for clarification.
.3 Any instructions or clarifications to Bidders issued during the period of bidding will be in the form of Addenda and are to be included in the tender. Addenda will form part of the Contract Documents.
.4 The Owner, User Groups or Consultant will not be responsible for verbal instructions.
.5 All addenda will be posted to the Holland College procurement opportunities website and it is the bidders responsibility to make sure they are in receipt of all addenda. No addenda will be issued by email to bidders (https://hollandcollege.com/about/communication/rfps/index.html).

1.8 PREPARATION AND SUBMISSION OF BIDS

.1 Contractors shall submit their bids on the Tender Form provided, which will be received at the time and place indicated on the Invitation to Tender. Late tenders will not be accepted and will be returned unopened to the bidder.
.2 Bidders shall fill in all information requested on the Tender Form.
  .1 This form must be completely filled out in ink, or be typewritten with the signature in longhand. The completed forms shall be without interlineation, alteration or erasure.
  .2 Failure to fill in the Tender Form, as provided, in its entirety may result in the rejection of the bid; however, bidders are not obligated to provide alternative prices to products listed on the Appendix provided for that specific purpose, as part of the tender form.
  .3 Tender amount shall be stated both in writing and in figures.
  .4 Signatures shall be without alteration or erasure.

.5 Receipt of addenda for the project shall be acknowledged by filling in the addendum number and date of issue for each addendum on the appropriate line on the Tender Form. These lines shall be initialed by the person signing the tender after they have been filled in.

.3 Each tender submitted will be accepted on the understanding that it covers all the Work called for in the specifications and on the drawings, regardless of any notations by Bidder that certain parts of the required Work are omitted from their proposal.

.4 Each bid must:

.1 Give the full business address of the Bidder and be signed by the Bidder with their usual signature.

.2 Bids by partnerships must furnish the full name of all partners and must be signed in the partnership name of one of the members of the partnership or by some authorized representative, followed by the signature and designation of the person signing.

.3 Bids by corporations must be signed with the legal name of the corporation, followed by the name of the Province of incorporation, and by the signature designation of the president, secretary, or other person authorized to bind it in the matter. The name of each person signed shall also be typed or printed below the signature.

.4 A bid by a person who affixes to his signature the word "president," "secretary," or "agent," or other designation, without disclosing his principal, may be held to be the bid of the individual signing on behalf of the corporation.

.5 A bid of any individual or any group of individuals operating as co-partners or the bid of any corporation which may be submitted shall be executed and authorized so that it shall be and it will constitute a legal binding act of the persons, co-partners, or corporate entity making the bid.

.5 Bidders shall include with their tender, in the space designated in Section 00 41 13, Appendix A, the name of each Subcontractor and/or Supplier, as designated, whose price has been included in their tender and who will perform the trade work. Substitution for another Subcontractor in the event that the listed Subcontractor is unable to do the work shall be subject to the approval of the Owner and contingent on evidence satisfactory to the Owner that the original Subcontractor's price was legitimately carried in the Tender, and that the original Subcontractor is now incapable of carrying out the work required under the subcontract, or that he refuses to carry out the work and provides documented reasons for such incapacity or refusal.

.6 The term "Own Forces," as a subcontractor, may be used by a Bidder where the Bidder is equipped to and in fact normally carries out the trade work using employees in the direct employment of the Contractor or a wholly owned subsidiary company. Other designations such as "Own Estimate" are unacceptable and may be cause for rejection of the tender by the Owner.

.7 When a Bidder indicates "Own Forces" as a subcontractor, the Bidder may be required to demonstrate to the Owner that he has the resources, experience and employees necessary, available and qualified to perform the trade work in a manner and quality satisfactory to fulfill the obligations of the Contract Documents and that the trade work is a normal and continual part of his business operation.

.8 A Bidder, whose tender is accepted, that included "Own Forces" for a subcontract will if requested, provide the Owner with payroll records verifying that the employees carrying out the "Own Forces" subcontract work are direct employees of the Contractor or of a wholly owned subsidiary company of the Contractor.

.9 Each bidder shall be prepared, if so requested by the Owner, prior to the award of the Contract to present evidence of his experience, qualifications and financial ability to carry out the terms of the Contract.

.10 The Owner will evaluate Tenders submitted for this project. The criteria to be considered by the Owner in awarding the Contract will include a combination of:

.1 Bid price;

.2 Scheduling;

.3 Compliance;
.4 Expertise;
.5 Qualifications of the Contractor and named Subcontractors / Suppliers and
.6 Any other such conditions as may be determined by the Owner to be in the best interests of the Owner. A decision on the acceptance of a Tender will be made by the Owner based on the results of the Owner's evaluation.

.11 Bidders may, at their own discretion, submit Alternatives to items identified as "Acceptable Material".
.1 All proposed Alternatives shall be listed in Appendix "B", ALTERNATIVE PRICES and be identified by name and model number where applicable and each Alternative shall have an associated tender price change "INCREASED BY" $_____ or "DECREASED BY" $_____ or "N/A," as compared with the "Acceptable Material" item carried in the tender amount.
.2 Alternate prices will include ALL related costs associated with charges from Accepted Material. No additional costs will be accepted for failure of the Contractor to identify the full impact of using alternate systems.
.3 Alternate prices will NOT be used in determining the tender price or as the basis for awarding the tender.

.12 Bidders are to complete any other appendices forming part of the Tender Form as directed under Section 00 41 13 - Bid Form.

.13 Tender Forms and accompanying documents shall be enclosed in a sealed envelope marked "TENDER" and bearing the following identification.
.1 Name of project.
.2 Name of Contractor submitting tender.

.14 Envelope to be addressed to the recipient of tenders indicated in the Invitation to Tender and delivered by hand, registered mail or courier.

.15 Submit one (1) only signed copy of Tender Form.

.16 Accompanying the Tender Form shall be:
.1 One (1) copy of Bid Guarantee, together with Surety's Letter of Consent, as specified.
.2 One (1) copy of a preliminary schedule demonstrating the full scope of work to be completed within the identified time for the completion of the contract work.
.3 One (1) copy of a letter from Bidder's insurance provider identifying a list of any claims made against the Bidder within the last five (5) years.

.17 Tender forms and securities must bear original signatures.

.18 Where the bid amount is shown in both written words and number and the two are in conflict, written words will take precedence.

1.9 BID GUARANTEES

.1 Security Deposits:
.1 Bids are to be accompanied by a security deposit as follows:
.1 General Contract Bid less than or equal to One Million ($1,000,000.00) Dollars, including mechanical and electrical subcontract values:
.1 A Bid Bond equal to at least ten percent (10%) of the Bid amount and a Letter of Surety from a bonding company guaranteeing to supply a Performance Bond in the amount of fifty percent (50%) of the total bid amount.

OR

.2 A Security Deposit equal to at least ten percent (10%) of the Bid amount.
.2 General Contract Bid more than One Million ($1,000,000.00) Dollars, including mechanical and electrical subcontract values:
.1 A Bid Bond equal to at least ten percent (10%) of the Bid amount and a Letter of Surety from a bonding company guaranteeing to supply a

Performance Bond and a Labour and Material Payment Bond, each in the amount of fifty percent (50%) of the bid amount.

.2 The Certified Cheque, Bank Draft or Bid Bond shall be made payable to the Owner.

.3 The Certified Cheque, Bank Draft or Bid Bond will guarantee that:

.1 The Bidder will not withdraw the bid for the period indicated on the Tender Form, following the schedule closing time of the receipt of bids, and

.2 The Bidder will enter into a formal agreement with the Owner in accordance with the agreement included as part of the Contract Documents, and

.3 The required Certified Cheque, Bank Draft or Bid Bond as Contract Security will be provided to the Owner, and

.4 In the event of withdrawal of said bid within said period, or the failure to enter into said Agreement and give said contract security within ten (10) days after notice of the acceptance of the bid, the Bidder shall be liable to the Owner for the full amount of the bid guarantee as representing the liquidating damages to the Owner on account of the default of the Bidder in any particular hereof and shall not be construed as a penalty.

.4 Bid Bonds or Security Deposits will be returned to all except the three (3) lowest Bidders within three (3) days after the opening of tenders. The remaining non-successful Bid Bonds or Security Deposits will be mailed to Bidders within forty-eight (48) hours after the Owner and the successful Contractor have executed the Contract and the duly executed Bonds or Certified Cheque representing the Contract Security have been received and accepted by the Owner from the successful Contractor.

.5 Bonds and Letters of Surety, provided by General Contractors to the Owner shall be from a recognized Surety Company.

.6 Only Bid Bonds issued by insurers, licensed in Canada and authorized to do business in the Province of Prince Edward Island, will be accepted.

.7 Security Deposits provided by General Contractors:

.1 Must be in the form of a Certified Cheque or Canadian Bank Draft drawn on a bank to which the Bank Act applies or a Credit Union, payable to the Owner, OR

.2 Bonds of the Government of Canada, unconditionally guaranteed, as to the principal and interest by the Government of Canada if such Bonds are:

.1 Payable to the Bearer, or

.2 Accompanied by a duly executed Instrument of Transfer to the Owner in the form prescribed by the Domestic Bonds of Canada Regulations, or

.3 Negotiated as to principal or as to principal and interest in the name of the Owner, pursuant to the Domestic Bonds of Canada Regulations.

.3 Security Deposits submitted by Subcontractors to General Contractors, shall be in a form satisfactory to the General Contractor.

.4 No interest will be paid to either the successful or unsuccessful bidders for any form of Bid Guarantee.

.8 Agreement to Bond

.1 When a Bid Bond is provided as security deposit with a bid; submit an agreement to bond, stating that the surety providing the Bid Bond is willing to provide the Performance and Labour and Materials Bonds specified.

.2 Include cost of bonds in bid price.

1.10 CONTRACT SECURITY

.1 Upon award of a Contract, the Contractor shall provide the following Contract Security:

.1 For a General Contract Tender less than One Million Dollars ($1,000,000.00), including Civil, Mechanical, Sprinkler, and Electrical Subcontract values:

.1 A Performance Bond in the amount of fifty per cent (50%) of the total Contract Amount, or

.2 A Security Deposit in the form of a Certified Cheque or Bank Draft, in an amount not less than ten per cent (10%) of the total Contract Amount.

.2 For a General Contract Tender One Million Dollars ($1,000,000.00) or more, including Civil, Mechanical, Sprinkler and Electrical Subcontract values:
.1 A Performance Bond and a Labour and Materials Bond, each in the amount of fifty per cent (50%) of the total Contract Amount.

.2 All Bonds provided by General Contractors, are to be made payable to the Owner.

.3 Bonds shall be from a recognized Surety Company, licensed in Canada and authorized to do business in the Province of Prince Edward Island.

.4 If a Performance Bond is utilized, it shall be maintained in force for a period of not less than twelve (12) months after the issuance of the Total Performance Certificate.

.5 Security Deposits, provided by the General Contractor:
.1 Must be in the form of a Certified Cheque or Bank Draft drawn on a bank to which the Canadian Bank Act applies, or a Credit Union, payable to the Owner, OR
.2 Bonds of the Government of Canada, unconditionally guaranteed, as to the principle and interest by the Government of Canada if such Bonds are:
.1 Payable to the Bearer, or
.2 Accompanied by a duly executed Instrument of Transfer to the Owner, in the form prescribed by the Domestic Bonds of Canada Regulations, or
.3 Negotiated as to principle or as to principle and interest in the name of the Owner pursuant to the Domestic Bonds of Canada Regulations.

.6 Contract Security shall be provided at the expense of the General Contractor. Cheques or Bank Drafts shall be drawn on an account with recognized Financial Institutions.

.7 Contract Security submitted by Subcontractors to General Contractors, shall be in a form acceptable to the General Contractor.

.8 No interest will be paid to the successful Contractor on any form of Contract Security.

.9 If in accordance with the Contract Security requirements the successful Contractor has used a Certified Cheque or Bank Draft as Contract Security, the Certified Cheque or Bank Draft will be deposited in a safety deposit box in a bank until the date of Substantial Performance for the Contract as defined under Definitions and GC 5.4 of CCDC2-2020. Subject to the Work being acceptable to the Owner and Consultant it will be returned to the Contractor, without interest. The Certified Cheque or Bank Draft used as contract Security used through the construction period will be replaced with a Certified Cheque or Bank Draft in the amount of 20% of the original Contract Security during the Warranty Period. Subject to Warranty issues being addressed during the 1-year Warranty Period to the satisfaction of the Owner and Consultant it will be returned to the Contractor, without interest.

1.11 RECEIPT AND OPENING OF BIDS

.1 Bids will be opened privately at the time and place stated in the Invitation to Tender. The officer whose duty it is to open them will decide when the specified time has arrived. No responsibility will attach to any officer for the premature opening of a bid not properly addressed and identified.

.2 Emailed bids will only be considered.

1.12 ADJUSTMENT AND WITHDRAWAL OF BIDS

.1 Bids may be withdrawn or adjusted in writing by email only, delivered to the party to whom the bids were submitted, provided such withdrawal or adjustment is prior to the time fixed for the opening of the bids. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal or adjustment of the bid after the expiration of the time within which bids may be submitted.
.1 All withdrawals or adjustments to previously submitted tenders must be emailed to Daniel Morris (djmorris@hollandcollege.com) and cc'd to Scott MacNeill (smacneill@colesassociates.com), prior to the time fixed for the opening of bids.
.2 Neither the Owner nor Coles Associates Ltd. accepts responsibility for the Contractors inability to submit emailed modifications within the allotted time for such circumstances, including but not limited to power and equipment failures, etc.

.3 Adjustments must be signed by the same person who signed the original bid.

1.13 AWARD OF CONTRACT

.1 The Contract, if awarded, will be awarded as promptly after the opening of bids as is possible, and at the discretion of the Owner. The award date will not extend beyond the period indicated on the Tender Form following the scheduled time of tender closing, without first obtaining permission of the three (3) low bidders, or low bidder only, at the discretion of the Owner.

.2 The Form of Agreement, (Contract) which the successful Bidder will be required to enter into with the Owner, may be seen on application to the Consultant. The drawings, specifications and any addenda issued during the tender period, will be suitably marked for identification at the time the Form of Agreement is signed by both parties, shall be considered as being included in the Contract, together with the completed Tender form and are hereinafter referred to as the "Contract Documents." All of these documents shall be read together and construed as one document. Following execution of the Contract, the Contractor shall receive from the Owner one (1) complete signed set of Contract Documents.

.3 Final award of Contract shall be subject to approval of all agencies having direct interest in the project.

.4 Where identical bids are received, the low bidder will be selected on the basis of a coin toss by the Owner in the presence of the identical bidders.

1.14 REJECTION OF BIDS

.1 The Owner reserves the right to reject any and all bids.

.2 The lowest or any bid will not necessarily be accepted.

.3 Bids submitted which indicate "own forces" for subcontract work, that in the opinion of the Owner cannot be successfully completed by the Contractor's employees will not be accepted.

.4 Bids not submitted on the required form will be rejected.

.5 Bids which are incomplete or qualified will be rejected.

.6 All Bidders acknowledge that they shall have no claim against, or entitlement to damages from the Owner or Consultant by reason of the Owner's rejection of their individual bids or all bids.

1.15 SUBCONTRACT WORK

.1 Contractor is to ensure that all Subcontractors understand the full extent of their responsibilities in order to complete the entire work of the project. Subcontract work may appear in various Sections of Specifications and on various Drawings.

.2 Contractors and their Subcontractors are advised to become familiar with all specifications and drawings.

1.16 CONDITIONS OF WORK AND EMPLOYMENT IN PEI

.1 All Construction Companies and Contractors and subcontractors submitting tenders for this work, or a portion thereof, are advised, in their own interest, to contact the Construction Association of Prince Edward Island, the accredited association for commercial and industrial sectors of the construction industry, to inquire and determine the terms and conditions of work and employment in the Province of Prince Edward Island.

1.17 LABOUR

.1 No prospective employee in the Province of Prince Edward Island shall, with relation to his employment or eligibility for employment, be discriminated against or favored by reason of sex, racial origin, religious views, or political affiliations.

.2 Contractors, to the extent possible, are encouraged to maximize the employment of the local labour force for the Work of this Contract.

1.18 HARMONIZED SALES TAX REQUIREMENTS

.1 The Owner for this project must account for the Harmonized Sales Tax (HST).

.2 All tenders submitted for the work of this Contract shall be calculated on the basis that the Owner is not exempt from HST. The bid will exclude HST but will show it as a separate line item.

1.19 ACCEPTABLE PRODUCTS

.1 The Bidder shall carry in his tender the base bid product(s) identified in the specifications as "Acceptable Material", or Approved Equals as they are identified throughout the tender period.

.2 The Bidder is also encouraged to carry the products of other manufacturers, that are not considered equals, as "Alternatives Prices," listing them by name on the Appendix provided for that specific purpose, as part of the Tender Form, together with the price difference compared to the specified products, when such Appendix is identified under Section 00 41 13 - Bid Form.

1.20 APPROVED EQUALS

.1 Submission for an Approved Equal is to contain literature and descriptive information with full specification data. Where the requested item is contained on a printed document with other items, it is to be clearly identified.

.2 The Consultant will not search catalogs, e-mails or websites or contact suppliers to obtain the necessary information for proper evaluation.

.3 Submission by Bidders for evaluation of products requested to be considered as equal must be submitted to Consultant no less than five working days prior to closing of tenders. No consideration will be given to approving equals after the close of tenders, except when the specified product is found to have been discontinued by the manufacturer.

.4 The consideration of a product(s) for Approved Equal status and the acceptance of individual products as approved equals is entirely at the discretion of the Consultant.

.5 When products are given Approved Equal status these products may, at the discretion of bidders, be carried in their tender price, provided that ALL costs related to changes to the contract work required to incorporate the Approved Equal product are included in the tender price.

.6 The acceptance of a product by the Consultant as an "Approved Equal," even where not specifically indicated on the Approved Equals listing in the Addendum, is to be understood as being contingent upon the provision of the particular series, model and/or type, complete with all options to meet the specified requirements of the Acceptable Material product.

.7 Products given approved status that are found, during construction period, to not have all specified options available, or to have discontinued production of same, or to have made other design changes since the time of approval, will not be accepted for use on this project, except when financial compensation has been mutually agreed upon between the Contractor and the Owner and deemed acceptable by the Consultant. Compensation will not be paid to the Contractor for products acknowledged by the Consultant to be superior to the specified products.

1.21 ALTERNATIVES

.1 Alternative products, when requested under Section 00 41 13 - Bid Form, must be listed in Appendix "B" provided as part of the Tender Form, and are to be understood as being offered only for the Owner's consideration as substitutes for the specified Acceptable Material products, at the amount of increase or decrease in the tender amount indicated in the Appendix. These products and related prices are not to be included in the tender amount.

.2 Alternative products and their related increase or decrease in the base bid amount are not used as the basis for awarding tenders.

.3 When alternative products are listed in Appendix "B", ALL costs related to changes to the contract work required to incorporate the alternative product into the work are to be included in the amount stated in Appendix "B".

.4 Alternative products may or may not be accepted at the discretion of the Owner at the price difference quoted, without any other monetary consideration. If requested, bidders shall promptly supply full details of any or all Alternatives listed. Specific written direction from the Consultant must be given to the Contractor to substitute an alternative product.

.5 Alternative prices shall include all fees, taxes and markups.

1.22 UNIT PRICES

.1 Unit Prices, when requested under Section 00 41 13 - Bid Form, must be listed in Appendix "C", as part of the Tender Form and are to be understood as being offered only for the Owner's consideration; to be accepted or not accepted, at the Owner's discretion in a timely manner during the Work of the Contract, ONLY as a method of adjustment to the Contract Work for changes in the Work, should the Owner opt for the Unit Price Method.

.2 Unit prices shall include all fees, taxes and markups.

1.23 SEPARATE PRICES

.1 Separate Prices, when requested under Section 00 41 13 - Bid Form, must be listed in Appendix "D", as part of the Tender Form and are to be understood as being offered only for the Owner's consideration; to be accepted or, not accepted, in whole or in part, at the Owner's discretion. If used the Separate Prices may be incorporated into the Contract Work either at the time of Award of Contract or in a timely manner during the Work of the Contract, at the Owner's discretion.

.2 Separate Prices shall include all fees, taxes (excluding HST) and markups.

1.24 GUARANTEES

.1 The Contractor will be required to guarantee the work of this Contract in accordance with the requirements of GC12.3 of the Agreement.

.2 Not withstanding the above, the bidder's attention is directed to the fact that certain individual items on this project may be required to be guaranteed by the manufacturer for periods in excess of twelve months. These specific requirements are to be found in various Sections of the specifications for this project.

1.25 PAYMENT OF WORKERS

.1 The Contractor shall, in addition to any fringe benefits, pay the workers employed by the Contractor on the work at wage rates, not less than those established by the Minimum Wage Order, issued under authority of the Labour Act, which is in effect. The Contractor shall pay workers employed on the work at intervals of not less than twice per month.

.2 The Contractor shall require each Subcontractor, or person doing any part of the work, to covenant with the Owner that workers are employed at the wage rates and in the manner required by this provision.

.3 Where any person employed by the Contractor or any Subcontractor, or other person engaged on the Work of this Contract, is paid less than the amount required to be paid under the provisions of this Contract, the Owner may deduct from any monies payable to the Contractor, under this or any other Contract, and pay to such person, a sum sufficient to bring the person's wages up to the amount required to be paid under this Contract.

.4 No claim for extra payment from the Contractor will be considered by the Owner concerning any change in the Minimum Wage Order which may occur during prosecution of the Contract.

1.26 CONFIDENTIALITY AND FREEDOM OF INFORMATION

.1 By submitting your bid, you agree to disclosure of the information supplied, subject to the provisions of the Freedom of Information and Protection of Privacy (FOIPP) Act.

.2 Anything submitted in your bid that you consider to be "confidential information" because of its proprietary nature should be marked as "Confidential", and will be subjected to appropriate consideration under the Freedom of Information and Protection of Privacy Act.

.3 During the delivery and installation of goods and/or services, you may have access to confidential or personal information. Should this occur, you must ensure that such information is not released to any third party or unauthorized individual.

.4 Any information provided on this contract may be subjected to release under the Freedom of Information and Protection of Privacy Act. You will be consulted prior to the release of any information.

1.27 TIMING REQUIREMENTS

.1 This project will require the achievement of the following project milestones:

.1	Tender Call	29 OCT 2026
.2	Pre-Tender Site Meeting	03 NOV 2026 @ 2:00 PM
.3	Tender Close	12 NOV 2026 @ 2:00 PM **Refer to item TENDER CALL of this section for the address.**
.4	Award Date	One (1) week following Tender Close.
.5	Construction Start	Immediately following Award.
.6	Owner Occupancy	09 APR 2027

END OF SECTION

1 General

1.1 TENDER

.1 SUBMITTED BY:

_____(Name)

_____(Address)

_____(Contact)

DATE: _____

FOR:	PROJECT NAME:	Holland College Summerside Waterfront Campus Greenbuild Trade Expansion
	LOCATION:	98 Water Street, Summerside, PE
TO:	PROJECT OWNER:	Holland College
	LOCATION:	140 Weymouth Street, Charlottetown, PEI

Having examined ALL the drawings and specifications for this project, as well as any addenda issued, as prepared by Coles Associates Ltd. and/or their consultants; WE HEREBY OFFER to furnish all materials, plant and labour necessary for the full and proper completion of the Contract work for:

PROJECT NAME:	Holland College Summerside Waterfront Campus Greenbuild Trade Expansion
LOCATION:	98 Water Street, Summerside, PE

INCLUDING all prime cost allowances and Government sales or other taxes in force at this date, EXCLUDING Harmonized Sales Tax (HST) but not any other additional or deductible allowances or taxes which may be applicable subsequent to this date, and which shall be payable by or to the Owner, in accordance with the above mentioned Documents, for the bid amount of:

_____(Dollars)
($)

in lawful money of Canada.

In submitting this Tender we recognize the necessity to complete the information requested by any appendices, as well as, the right of the Owner to reject all Tenders or to accept any Tender at the price submitted, on the condition that revised Tenders will not be called for if minor changes are made.

In the event of this Tender being accepted within 60 days of the time stated for the closing of Tenders, and our failing or declining to enter into a Contract, then our Bid Guarantee, submitted with our Tender shall be forfeited to the Owner in lieu of any damages which the Owner may suffer by reason of our failure or refusal to enter into such Contract.

In the event of our Tender not being accepted with 60 days of the time stated for the closing of Tenders, our Bid Guarantee, submitted with our Tender will be returned to us forthwith,

unless a satisfactory arrangement is made with us covering its retention for a further stated period.

If we are notified of the acceptance of this Tender within the above specified time, we will:

.1 Enter into a formal Contract Agreement with the Owner.
.2 Furnish the Performance Bond and Labour and Materials Payment Bonds, or other form of Contract Security, when specifically permitted, as Contract Security in accordance with the requirements of the specifications.
.3 Furnish a cost breakdown of the Contract sum, the total aggregating the amount of our Tender, in accordance with the requirements of the specifications.
.4 Furnish a certified copy of all insurance policies.
.5 Complete the entire work on or before the dates stated.
.6 Provide and update as required a Construction Schedule which clearly shows the state of progress required to complete the work on the date specified.
.7 Enter into subcontract agreements where applicable.

1.2 ACKNOWLEDGEMENT OF RECEIPT OF ADDENDA

.1 Addendum No. _____ Issued: _____ _____ initial

Addendum No. _____ Issued: _____ _____ initial

Addendum No. _____ Issued: _____ _____ initial

Addendum No. _____ Issued: _____ _____ initial

Addendum No. _____ Issued: _____ _____ initial

1.3 FORM OF TENDER APPENDICES

.1 Appendix 'A' must be completed by bidders.

1.4 DOCUMENTS ACCOMPANYING BID FORM

.1 As per Section 00 21 13 - Instructions to Bidders:

One (1) copy of Bid Guarantee, together with Surety's letter of consent. _____initial
One (1) copy of preliminary schedule. _____initial
One (1) copy of letter from Bidders Insurance Provider identifying list of claims made against Bidder within last five (5) years. _____initial

1.5 PROJECT MANAGER & SUPERINTENDENT

.1 Name of Project Manager _____.

.2 Years of Experience with Contractor _____.

.3 Name of Superintendent _____.

.4 Years of Experience with Contractor _____.

1.6 CONFLICT OF INTEREST

.1 The Contractor warrants that as at the date of this Agreement, no conflict of interest, or any circumstance that might interfere with independent and objective exercise of judgment, exists or is likely to arise in relation to execution of this Agreement or its subject matter. The Contractor shall immediately notify Owner, in writing, if any such actual or potential conflict of interest should arise at any time during the Term. In the event Owner discovers or is notified by the Contractor of an actual or potential conflict of interest, the Owner, in its sole discretion, may either:

.1 Allow the Contractor to resolve the actual or potential conflict to the satisfaction of the Owner
OR

.2 Terminate the Agreement in accordance with the Termination section of this Agreement.

1.7 CONTRACTOR'S SIGNATURE

.1 Signed sealed and submitted for and on behalf of:

_____
(Company Name)

_____

_____
(Address)

_____ _____
(Authorized Signature) (Witness)

_____ _____
(Name and Title) (Name and Title)

_____
(Date)

1.8 APPENDIX 'A'

.1 Herewith are identified the Subcontractors we propose to use on this project.
Carrying Sub-Contractor options next to identified work, is not acceptable. The words TBD, own estimate, allowance and no bids received are also not acceptable and will be cause for rejection. All blanks shall be filled in with Subcontractor name or with the words Own Forces.

Site Demolition: _____

Excavation Work: _____

Asphalt Paving Work: _____

Building Concrete Work: _____

Structural Steel: _____

Metal Stud: _____

Gypsum Wall Board: _____

Metal Siding: _____

HM Doors and Frames: _____

Wood Doors: _____

Windows: _____

Glazing: _____

Door Hardware: _____

Flooring: _____

Firestopping: _____

Painting: _____

Mechanical: _____

Controls: _____

Electrical: _____

COMPANY: _____

AUTHORIZED SIGNATURE: _____

END OF SECTION

1 General

1.1 FORM OF AGREEMENT

.1 The Form of Agreement between Contractor and Owner shall be Canadian Construction Documents Committee CCDC2-2020, "Stipulated Price Contract", including the Definitions and General Conditions therein including items GC1.1 inclusive to GC13.2, and the modifications to items GC1.1 to GC13.2 incorporated into Section 00 73 00 - Supplementary Conditions of this Specification.

.2 Document CCDC2-2020 may be examined at the Construction Association office in Charlottetown, PEI.

END OF SECTION

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1 General

1.1 GENERAL

.1 These Supplementary Conditions modify, delete and/or add to the Agreement between Owner and Contractor, the Definitions, and the General Conditions of the Stipulated Price Contract, Standard Construction Document CCDC 2 – 2020.

.2 Where any Article or portion of Article conflicts with the Laws of the Province concerned, such Article or portion of the Article is hereby stricken.

1.2 SUPPLEMENTARY CONDITION 1; AGREEMENT BETWEEN OWNER AND CONTRACTOR

.1 SC1.1; Article A-5 - Payment:

.1 Delete paragraph 5.2 and replace it with the following:

"5.2 Should either party fail to make payments as they become due under this Contract or in an award by arbitration, adjudication or court, interest will begin to accrue on the amount that is not paid from the date when it is due until the date it is paid at the prejudgment interest rate prescribed by the Provincial Court of PEI."

1.3 SUPPLEMENTARY CONDITION 2; CCDC2 - 2020, DEFINITIONS

.1 Amend the following Definitions:

.1 Amend the Definition of “Consultant” by adding the following to the end:

.1 “For purposes of this Contract, the terms “Consultant”, “Architect” and “Engineer”, wherever used in the Contract Documents, shall be considered synonymous. The term "Consultant" means the Consultant or Consultants authorized representative.
The Consultant shall be the Owner's Prime Consultant, Coles Associates Ltd., 85 Fitzroy Street, Charlottetown, PEI."

.2 Amend the Definition of “Owner” by adding the following to the end:

.1 The Owner shall be Holland College.

.3 Amend the Definition of "Subcontractor" by adding the following to the end:

.1 All dealings with the Subcontractor shall be through the medium of the Contractor, who will be responsible for the proper coordination and execution of the Sub-contractor's work.

.2 Add the following new Definitions:

.1 **Act**
“*Act* means the Construction Act (PEI), as amended.”.

.2 **As-Built Drawings**
“*As-Built Drawings* are the drawings prepared by the C*ontractor* by marking on a copy of the Drawings the changes from the Drawings which occur during the course of the Work including, but not limited to, the exact location of major building components and structures that were shown generally on the Drawings. For certainty, *As-Built Drawings* shall be in computer-aided design (CAD) format approved by the *Owner*, as well as in paper and PDF formats.”

.3 **Deficiency Rectification Security**
“*Deficiency Rectification Security* means the amount and the form of security to be delivered by the *Contractor* pursuant to GC 5.4A – DEFICIENCY RECTIFICATION SECURITY.”

.4 **Engineer**
"The *Engineer* shall mean the designated engineering representative(s) of the *Consultant*."

.5 **OHSA**
“*OHSA* means the Occupational Health and Safety Act (PEI), as amended, and all rules and regulations passed under it.”

.6 **Proper Invoice**
"*Proper Invoice* means an application for payment given by the *Contractor* to the *Owner* that fully complies with the requirements of GC 5.1A – PROPER INVOICE."

.7 **Provide**
"*Provide* means supplied and installed."

.8 **Submittals**
"*Submittal*s are documents or items required by the *Contract Documents* to be provided by the *Contractor*, such as:

.1 *Shop Drawing*s, samples, models, manuals, mock-ups to indicate details or characteristics before the portion of the *Work* that they represent can be incorporated into the *Work*; and

.2 *As-Built Drawings* and manuals to provide instructions to the operation and maintenance of the *Work*."

.9 **WCB**
"*WCB* means the PEI Workers Compensation Board."

1.4 SUPPLEMENTARY CONDITION 3; GENERAL CONDITIONS

.1 GC 1.1 CONTRACT DOCUMENTS

.1 Amend paragraph 1.1.2 by adding the following to the end:
"The intent of the Contract Documents is to include all labour, Products, materials, Construction Equipment and services necessary or normally considered necessary for the performance of the Work in accordance with the Contract Documents. Any item of Work mentioned in the Contract Documents or reasonably inferable from the Contract Documents but not otherwise shown or described shall be provided by the Contractor as if shown or otherwise described or inferable. Any items omitted from the Contract Documents which are reasonably necessary or inferable for the completion of the Work shall be considered a portion of the Work and included in the scope of Work to be performed under this Contract."

.2 Amend paragraph 1.1.5 as follows:

.1 Amend paragraph 1.1.5.1 by changing the order of the first four bullet points so that, as reordered, the bullet points read as follows:
".1 the order of priority of documents, from highest to lowest, shall be
- Supplementary Conditions,
- the Agreement between Owner and the Contractor,
- the Definitions,
- the General Conditions"

.2 Amend paragraph 1.1.5 by adding the following new paragraph 1.1.5.6:
".6 Notwithstanding the foregoing, if there a conflict or discrepancy between Drawings or between Drawings and Specifications or any other Contract Documents in relation to the Products to be supplied or the amount of labour or materials required to complete a particular item of Work, the Contractor shall supply and shall include in the Work the Products, labour and materials which would provide the greatest benefit to the Owner, as determined by the Owner."

.3 Amend paragraph 1.1.9 by adding new paragraphs 1.1.9.1 and 1.1.9.2 as follows:
".1 The Specifications shall be read as a whole and are the minimum construction requirements. Neither the organization nor the division of the Specifications nor anything else contained in the Contract Documents will be construed to place responsibility on the Consultant to settle disputes among the Subcontractors and Suppliers in respect to such organization or division.

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

.4 Amend paragraph 1.1.11 as follows:

.1 Delete the words "at the Owner's expense".

.5 Add new paragraphs 1.1.12 to 1.1.16 as follows:

"1.1.12 The Contract Documents and are intended solely for use by the party with whom the Consultant has entered into a Contract, and there are no representations of any kind made by the Consultant to any party with whom the Consultant has not entered into a Contract.

1.1.13 If the Contractor finds any error, inconsistency or omission in the Contract Documents or has any doubt as to the meaning or intent of any part thereof, the Contractor shall immediately notify the Consultant, who will provide written instructions or explanations. Neither the Owner nor the Consultant will be responsible for oral instructions.

1.1.14 Electronic documents are and shall remain the Consultant's property. Copies of electronic documents may be made available for the preparation of Shop Drawings at the Consultant's sole discretion and for a fee.

1.1.15 The Consultant will provide the Contract Documents in PDF format to the Contractor. The Contractor shall be responsible for printing, reproducing, and distributing all required sets of Drawings and Specifications to the Subcontractors and Trades at the Contractor's own expense for completing the work. No hard copies will be provided by the Owner or Consultant.

1.1.16 The Contractor shall keep one copy of the current Contract Documents, Supplemental Instructions, proposed or Contemplated Change Notices, Change Orders, Change Directives, Record Drawings marked up with any changes to be included in As-Built Drawings, cash allowance disbursement authorizations, reports, records meetings, and reviewed Shop Drawings at the Place of the Work, in good order and available to the Owner and Consultant."

.2 GC 2.2 ROLE OF THE CONSULTANT

.1 Add new paragraph 2.2.19 as follows:

"2.2.19 The Consultant will not be responsible for and will not have control, charge or supervision of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs required in connection with the Work in accordance with the applicable construction safety legislation, other regulations or general construction practice.
The Consultant will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Consultant will not have control over, charge of or be responsible for the acts or omissions of the Contractor, Subcontractors, Suppliers, or their agents, employees, or any other persons performing portions of the Work."

.3 GC 2.4 DEFECTIVE WORK

.1 Amend paragraph 2.4.1 by inserting the words ", at the Contractor's sole cost and expense," after the words "The Contractor shall" in the first line of the paragraph.

.2 Add new paragraphs 2.4.4 and 2.4.5 as follows:

"2.4.4 The Contractor shall rectify, in a manner acceptable to the Owner and the Consultant and without cost or expense to the Owner, all defective Work and deficiencies throughout the Work, whether or not they are specifically identified by the Consultant.

2.5.5 The Contractor shall give priority to the correction of any defective work or deficiencies identified as priorities by the Owner or the Consultant."

.4 GC 3.1 CONTROL OF THE WORK

.1 Amend paragraph 3.1.1 by adding the following new paragraphs 3.1.1.1 and 3.1.1.2 as follows:

"1 The Contractor shall co-ordinate his own work and the work of all Subcontractors so as to facilitate and expedite the progress of the work.

2 It is the responsibility of the Contractor to immediately notify the Consultant of any signs of distress or any other indications of actual or potential damage to the contract work, without regard to his awareness of any errors, inconsistencies or omissions in the Contract Documents."

.2 Add new paragraphs 3.1.3 through 3.1.7 as follows:

"3.1.3 The Contractor is solely responsible for the quality of the Work and shall undertake any quality control activities specified in the Contract Documents or, if none are specified, as may be reasonably required to ensure such quality. The Contractor shall perform the Work in accordance with modern practice and in accordance with applicable laws, ordinances, rules, regulations, or codes relating to the performance of the Work. Without limiting the generality of the foregoing, the Contractor is responsible for coordinating the Work so that no part shall be left in an unfinished or incomplete condition.

3.1. 4 The Contractor shall abide by and shall enforce directives and policies regarding signs, advertisements, fires, smoking and vaping at the Place of the Work as directed by the Owner.

3.1.5 The Contractor, without in any way limiting its responsibilities under this Contract, shall:

.1 perform the Work so as to avoid disturbing the occupants of any structures at the Place of the Work or any adjacent structures or the

public in general,

.2 respect and comply with local regulations and all Owner's requirements regarding permitted work hours, noise levels and work conditions,

.3 take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, to suppress dust and noise, to avoid conditions likely to propagate mould or fungus of any kind, and shall take all other steps reasonably necessary to promote and maintain the safety and comfort of the users and occupants of any structures at the Place of the Work or any adjacent structures and the public in general, and/or to maintain access to and the operation of such structures,

.4 take precautions not to allow any unauthorized visitors entry to the Place of the Work.

3.1.6 Prior to commencing the Work the Contractor shall verify, at the Place of the Work, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the Work and shall further carefully compare such field measurements and conditions with the requirements of the Contract Documents. Where dimensions are not included or exact locations are not apparent in the Contract Documents, the Contractor shall immediately notify the Consultant in writing and shall obtain written instructions before proceeding with any part of the affected Work. Failure to do so shall be at the sole risk and cost of the Contractor.

3.1.7 Before ordering any materials or doing any Work, Contractor shall verify all compensation has been allowed on account of differences between actual site dimensions and the measurements indicated on the drawings. Any difference, which may be found, shall be submitted to the Consultant for consideration before proceeding with the work.

3.1.8 The Contractor will be responsible for effecting the removal from the site of any trade, firm, group or person who is delaying the Work, or whose Work is unsatisfactory. The Contractor will arrange for other competent trades people to complete the Work at no expense to the Owner."

.5 GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

.1 Amend paragraph 3.2.2 by deleting the word "Owner" in the second line and replacing it with the word "Contractor".

.2 Delete paragraphs 3.2.2.2 and 3.2.2.3 in their entirety.

.3 Amend paragraph 3.2.3.4 by adding the following to the end:

.1 "Failure by the Contractor to so report shall invalidate any claims against the Owner by reason of the deficiencies in the work of Other Contractors or Owner's own forces except for those deficiencies not then reasonably discoverable; and".

.6 GC 3.4 CONSTRUCTION SCHEDULE

.1 Delete paragraph 3.4.1 and replace it with the following:

"3.4.1 The Contractor shall:

.1 within ten (10) Working Days of signing this Contract submit to the Owner and the Consultant, for the Owner's approval, a construction schedule that indicates the timing of major activities and critical milestone dates for the

Work, demonstrating that the Work will be performed in conformity with the Contract Time. Such schedule:

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

.2 at each site meeting, provide to the Owner and the Consultant a look-ahead schedule indicating the major activities to be undertaken in the next month."

.2 Amend paragraph 3.4 by adding the following new paragraph 3.4.2 as follows:
"3.4.2 The Contractor shall not change the scheduled Ready-for-Takeover date."

.7 GC 3.5 SUPERVISION

.1 Amend paragraph 3.5 by adding the following new paragraph 3.5.3 as follows:
"3.5.3 The Consultant may require the Contractor to inform him, in writing, of the name and experience of the supervisory personnel he intends to use on the project."

.8 GC 3.7 LABOUR AND PRODUCTS

.1 Amend paragraph 3.7 by adding the following new paragraph 3.7.4 as follows:
"3.7.4 All manufactured articles, materials and equipment shall be installed, applied, connected, erected, used, cleaned, conditioned and commissioned as directed by the manufacturer unless specified to the contrary."

.9 GC 3.8 SHOP DRAWINGS AND OTHER SUBMITTALS

.1 Delete the title of GC 3.8 as written and replace with the following wording "SHOP DRAWINGS AND OTHER SUBMITTALS".

.2 Amend paragraphs 3.8.1, 3.8.2, 3.8.3, 3.8.5, 3.8.6 and 3.8.7 by adding the words "and Submittals" after the words "Shop Drawings" wherever they appear in those paragraphs; and amend paragraphs 3.8.3.2 and 3.8.5 by adding the words "and Submittal" after the words "Shop Drawing" wherever they appear in those paragraphs.

.3 Add new paragraph 3.8.8 as follows:
"3.8.8 The Consultant's review of Shop Drawings and Submittals will be for general detail and arrangement only. The Consultant's review shall not relieve the Contractor from its responsibility for deviations from the Contract Documents, unless the Contractor in writing has notified the Consultant of such deviations at the time of submission of the Shop Drawings and Submittals and the Consultant has given written approval to the specific deviations. The Consultant's review shall not relieve the Contractor from responsibility for defective Work resulting from errors or omissions of any kind on the reviewed Shop Drawings and Submittals and shall not constitute authorization to the Contractor to perform additional Work or changed Work. The Contractor s solely responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes, and for techniques of construction and installation."

.10 GC 3.9 DOCUMENTS AT THE SITE

.1 Add new paragraph "3.9 DOCUMENTS AT THE SITE" as follows:

3.9 DOCUMENTS AT THE SITE

3.9.1 Contractor is to maintain at job site, one (1) copy of each document as follows:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed Shop Drawings.
.5 List of Outstanding Shop Drawings.
.6 Notice of Change.
.7 Change Orders.
.8 Other Modifications to Contract.
.9 Field Test Reports.
.10 Approved Work Schedule.
.11 Health and Safety Plan and Other Safety Related Documents.
.12 Other documents as specified."

.11 GC 4.1 CASH ALLOWANCES

.1 Delete paragraphs 4.1.4 and 4.1.5 and replace them with the following:

"4.1.4 Where the actual cost of the Work under any cash allowance exceeds or is expected to exceed the amount of the allowance, the Contractor shall notify the Owner and the Consultant in writing indicating the amount of additional funds required and, in such case, the Contractor shall not proceed with the cash allowance Work until the Contract or receives written instructions from the Consultant. Un-expended amounts from other cash allowances may be reallocated at the Owner's direction to cover the shortfall and, in that case, the Contractor is not entitled to any amount for overhead and profit. Where no such direction is given, or where the actual cost exceeds the allowance even after reallocation of un-expended amounts from other cash allowances, the Contractor shall be compensated for the excess incurred and substantiated, plus an amount for overhead and profit as set out in paragraph 6.2.3.3 of GC 6.2 – CHANGE ORDER, but on the excess only.

4.1.5 The net amount of any un-expended cash allowances, after providing for any re-allocations as contemplated in paragraph 4.1.4, shall be deducted from the Contract Price without any adjustment for the Contractor's overhead and profit on such amount."

.2 Add a new paragraph 4.1.8 as follows:

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

.12 GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

.1 Delete "GC 5.1. Financing Information Required of the Owner" in its entirety.

.13 GC 5.1A PROPER INVOICE

.1 Add a new "GC 5.1A Proper Invoice" as follows:

"5.1A Proper Invoice

.1 In this Contract a Proper Invoice shall mean an application for payment made by the Contractor that:

.1 is given to the Owner monthly by e-mail sent to ".com" and is sent concurrently to the Consultant or as the Owner may otherwise direct; and includes all of the following:

- .1 the *Contractor's* name and address and HST registration number;
- .2 the date of the application for payment and the period during which the services or materials were supplied;
- .3 information identifying the authority, whether in the *Contract* or otherwise, under which the services or materials were supplied, including the applicable RFT or purchase order number;
- .4 a description, including quantities where appropriate, of the services and materials that were supplied;
- .5 the amount payable for the services or materials that were supplied, and the payment terms. Ensure the amounts align with the *Contractor's* pricing form;
- .6 the name, title, telephone number and mailing address of the person to whom payment is to be sent;
- .7 copies of all *Change Orders* and *Change Directives* for which the *Contractor* is claiming payment together with all backup documentation;
- .8 a statement based on the schedule of values for the *Work;*
- .9 for all applications for payment except the final payment, the monthly report required by GC 3.4A – CONTRACTOR'S MONTHLY REPORTS, including an updated construction schedule which complies with the requirements of paragraph 3.4.1.1 of GC 3.4 – CONSTRUCTION SCHEDULE;
- .10 a current valid clearance certificate issued by the WCB;
- .11 for the second and all subsequent applications for payment, a CCDC 9A Statutory Declaration stating that all accounts for services and materials and other indebtedness incurred by the Contractor for which the Owner may in any way be held responsible have been paid in full, except for amounts properly retained as a holdback or as an identified matter in dispute."

.14 GC 5.2 APPLICATIONS FOR PAYMENT

.1 Amend paragraph 5.2.2 by adding paragraphs 5.2.2.1 and 5.2.2.2 as follows:

"5.2.2.1 Payment shall be less any holdback release, which may have been made in accordance with the specific terms of this Agreement as dictated by GC 5.6. Any such holdback release by the Owner to the Contractor shall be a payment to the Contractor in trust for the specific Subcontractor in respect of whose work the release is made.

5.2.2.2 Payments shall be less 15% Mechanics' Lien Holdback amount claimed against each progress claim."

.2 Delete paragraph 5.2.7 in its entirety.

.3 Amend paragraph 5.2.8 by adding the following wording to the end:
"Payment for materials will be considered only if such materials are properly stored on site in a secure enclosure acceptable to the Consultant. Security of materials so stored is the responsibility of the Contractor."

.4 Add new paragraphs 5.2.9 to 5.2.11 as follows:

"5.2.9 Authorized Change Orders shall be listed on the application for payment indicating the amount claimed against each to date of claim.

5.2.10 For the second and all subsequent applications for payment, a CCDC 9A Statutory Declaration stating that all accounts for services and materials and other indebtedness incurred by the Contractor for which the Owner may in any way be held responsible have been paid in full, except for amounts properly retained as a holdback or as an identified matter in dispute.

5.2.11 A current valid clearance certificate issued by the WCB;."

.15 GC 5.3 PAYMENT

.1 Delete paragraph 5.3.1 and replace it with the following:

"5.3.1 The *Consultant* will issue to the *Owner* and copy to the *Contractor* a certificate for payment in the amount applied for, or in such other amount as the *Consultant* determines to be properly due.

.2 Add new paragraphs 5.3.1.3 and 5.3.1.4 as follows:

"3 When any claim for payment during the course of construction includes for completed or partially completed Work, which in the opinion of the Consultant is defective or otherwise unacceptable, a sum of monies determined by the Consultant to be ten (10) times the value of the defective or unacceptable Work, or ten (10) times the value of the Work required to correct the defect or an amount solely at the Consultants discretion, will be withheld from the claim.

.4 Deficiency monies may be held back at any time during the course of the project for Work deemed incomplete or unacceptable.

.5 It remains the Contractor's responsibility to undertake his own deficiency reviews and ensure the entire Work conforms to the Contract including quality, completeness and commissioning.

.6 Two final deficiency reviews will be conducted by the Consultant. The first review with the Owner and Contractor will identify any minor items which may remain outstanding, and the second review will confirm that these items have been completed. All other deficiency reviews where deficiencies are incomplete or not ready for requested inspections, will be charged at cost to the Contractor. The invoice for the additional reviews will be submitted to the Owner with a corresponding amount deducted from the Contractor's progress payment."

.16 GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

.1 Add new paragraphs 5.4.1.3 as follows:

".3 Submit with application for payment letter of clearance from The Workers Compensation Board to the Owner stating that the Contractor is in good standing with the Board."

.17 SC 3.26 GC 5.5 FINAL PAYMENT

.1 Amend paragraph 5.5.2 by adding the following to the end:

.1 “Any delay in delivering the required Project Record Drawings (As-Builts) as described in Section 01 78 00 - Closeout Submittals will have the effect of delaying the final payment to the Contractor until the Consultant has received them complete and in good condition.”

.18 GC 5.8 WITHHOLDING OF PAYMENT

.1 Add a new "GC 5.8 Withholding of Payment: as follows:

"GC 5.8 WITHHOLDING OF PAYMENT

5.8.1 Notwithstanding any provision in the *Contract Documents* to the contrary, the *Owner* may withhold payment of any amount claimed in an application for payment, in a *Proper Invoice*, or in any certificate for payment to the extent required to offset any claims the *Owner* may have against the *Contractor*, or to offset previous overpayment made to the *Contractor*, or for damages or costs incurred by the *Owner*, or to the extent as may be necessary to protect and/or indemnify the *Owner* from loss, claims or damage, including as a result of:

.1 the *Contractor's* failure to perform any of its material obligations or where the *Contractor* is otherwise in default under the *Contract Documents*;

.2 defective portions of the *Work* not remedied;

.3 damage done by the Contractor to work performed by Other Contractors or by the Owner's own forces;

.4 the Contractor's failure to make prompt payments to its Subcontractors and Suppliers respecting Work for which the Owner has made payment to the Contractor;

.5 claims or reasonable evidence indicating possible commencement of claims for which the Contractor may be responsible to indemnify the Owner;

.6 the Contractor's failure to remove any liens arising from the Work or otherwise to satisfy its obligations under GC 14.2 – LIENS AND ACTIONS;

.7 reasonable evidence the Work will not achieve Ready-for-Takeover in accordance with the construction schedule or within the Contract Time;

.8 any claim for which the *Owner* is entitled to indemnification from the *Contractor* pursuant to the *Contract Documents*.

5.8.2 Where the *Owner* has withheld payment to the *Contractor* pursuant to the provisions of this *Contract*, the *Owner* shall be entitled to apply the amount toward the costs of any required remedial work, completion costs or toward damages or losses suffered and for which the *Owner* is entitled to compensation under this *Contract*, including legal costs and expenses."

.19 GC 6.2 CHANGE ORDER

.1 Delete paragraph 6.2.1 and replace it with the following:

"6.2.1 When a change in Work is proposed or required:

.1 The Consultant will provide the Contractor with a written description of the proposed change in the Work. The Contractor shall promptly present, in forms acceptable to the Consultant, a detailed breakdown of the costs associated with the change, if any; and the adjustment in the Contract Time, if any. The breakdown shall include:

.1 Actual (not list) costs of material, as well as Subtrade and Supplier costs.

.2 Labour costs, including fringe benefits and wage levies.
.3 Equipment rental (excluding hand and small power tool).

.2 Change Orders calling for normal changes or additions to the Work will be priced in detail giving actual material trade prices (not list prices) and actual labour costs and wage levies (including Employment Insurance, Worker's Compensation, Holiday Pay) and actual equipment rental.

.3 Each Change Order will be considered as a whole to complete the work, inclusive of all Sub- Contract and/or General Contract work.

.4 To these prices, the Contractor will add:

.1 For Work less than $2,500, involving the General Contractor only, the General Contractor adds 20% to his costs

.2 For Work over $2,500, involving the General Contractor only, the General Contractor adds 15% to his costs.

.3 For Work less than $2,500, involving a Subcontractor only, the Subcontractor adds 20% to his costs, submits this price to the General Contractor who adds 10%.

.4 For Work over $2,500, involving a Subcontractor only, the Subcontractor adds 15% to his costs, submits this price to the General Contractor who adds 5%.

.5 For Work less than $2,500, involving the General Contractor and a Subcontractor, the Subcontractor adds 20% to his costs, submits his price to the General Contractor who adds 10%; to this amount the General Contractor adds the cost of his own Work plus 20% of the cost of his own Work only. The General Contractor does NOT add a further 10% to the cost of his own Work.

.6 For Work over $2,500, involving the General Contractor and a Subcontractor, the Subcontractor adds 15% to his cost, submits this price to the General Contractor who adds 5%; to this amount the General Contractor adds the cost of his own Work plus 15% of the cost of his own Work only. The General Contractor does NOT add a further 5% to the cost of his own Work.

.7 Deletions to Contract: A mark-up by either Sub-Contractor or General Contractor shall not be charged or credited on credit Change Orders.

.8 Supervision related to Change Orders shall be considered as included in the allowable mark-up, and shall not be added as additional charges for a Change order.

.5 Note: Costs related to management, supervision, estimating, scheduling, bonding, insurance, as built drawings, copying, courier, safety, cleaning, site overhead, site vehicle, hand and small power tools etc. are covered by the mark up indicated and shall not be included on Change Orders.

.2 Add new paragraphs 6.2.3 to 6.2.5 as follows:

"6.2.3 The mark-ups referred to in paragraph 6.2.1.4 shall constitute the only compensation the *Contractor* shall be entitled to for any and all overhead,

profit, general expenses, incidental and administrative costs whatsoever related to a change including, but not limited to, costs relating to superintendence and supervision, general cleanup, *Shop Drawing* production, estimating, site office and head office expenses and personnel, administration costs, workers' tools, temporary facilities and controls, record drawings, *As-Built Drawings*, warranty, insurance, bonding, job safety costs, and coordination of any and all *Work*-related activities.

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

6.2.5 The *Contractor* shall not be entitled to any additional compensation or an adjustment to the *Contract Time* arising out of changes to the *Work* aside from the amounts stated in a *Change Order*. In no event shall the *Owner* be liable to the *Contract* for any costs, including indirect, impact or consequential costs, arising out of changes to the *Work* beyond the agreed upon amount of the *Change Order*."

.20 GC 6.3 CHANGE DIRECTIVE

.1 Delete paragraph 6.3.6 and replace it with the following:

"6.3.6 The adjustment in the Contract Price for a change carried out by way of a Change Directive shall be determined on the basis of cost of the Contractor's actual expenditures and savings attributable to the Change Directive, valued in accordance with paragraph 6.3.7 and as follows:

.1 The Owner or the Consultant, without invalidating the contract, may make changes by altering, adding to, or deducting from the work, the contract sum being adjusted accordingly. All such work shall be executed under the conditions of the Contract.

.2 Where work is required to proceed immediately, work may proceed under a Change Directive. The Contractor will be instructed to proceed on a time and materials basis and maintain accurate accounting records for the cost of the change.

.3 Change Directives calling for changes to the Work will be priced in detail giving actual material trade prices (not list prices) and actual labour costs and wage levies (including Employment Insurance, Worker's Compensation, Holiday Pay) and actual equipment rental.

.4 Each Change Directive will be considered as a whole to complete the work, inclusive of all Sub-Contract and/or General Contract work.

.6 To these prices, the Contractor will add:.

.1 For Work less than $2,500, involving the General Contractor only, the General Contractor adds 20% to his costs.

.2 For Work over $2,500, involving the General Contractor only, the General Contractor adds 15% to his costs.

.3 For Work less than $2,500, involving a Subcontractor only, the Subcontractor adds 20% to his costs, submits this price to the

General Contractor who adds 10%.

.4 For Work over $2,500, involving a Subcontractor only, the Subcontractor adds 15% to his costs, submits this price to the General Contractor who adds 5%.

.5 For Work less than $2,500, involving the General Contractor and a Subcontractor, the Subcontractor adds 20% to his costs, submits his price to the General Contractor who adds 10%; to this amount the General Contractor adds the cost of his own Work plus 20% of the cost of his own Work only. The General Contractor does NOT add a further 10% to the cost of his own Work.

.6 For Work over $2,500, involving the General Contractor and a Subcontractor, the Subcontractor adds 15% to his cost, submits this price to the General Contractor who adds 5%; to this amount the General Contractor adds the cost of his own Work plus 15% of the cost of his own Work only. The General Contractor does NOT add a further 5% to the cost of his own Work.

.7 Deletions to Contract: A mark-up by either Sub-Contractor or General Contractor shall not be charged or credited on credit Change Orders

.8 Supervision related to Change Orders shall be considered as included in the allowable mark-up, and shall not be included in the labour changes for a Change order."

.21 GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

.1 Add a new paragraph 6.4.0 as follows:

".0 The Contractor confirms that, before signing this Contract, it carefully investigated and examined the Place of the Work, the Contract Documents and any other documents made available by the Owner, and has satisfied itself as to the conditions, circumstances, limitations and requirements necessary for the Contractor to perform the Work in accordance with the Contract Documents. No allowances will be made for additional costs and no claims by the Contractor will be considered for an adjustment in the Contract Price or Contract Time in connection with conditions which were reasonably apparent or which could reasonably have been discovered before the signing of this Contract."

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

.1 Add a new paragraph 7.1.7 as follows:

".7 The Owner may terminate this Contract for convenience at any time for any or no reason. In such event, the Owner shall pay for the Work performed up to the effective date of termination, including demobilization costs, and for such additional reasonable direct costs directly flowing from and which are a reasonable consequence of the termination, but excluding the costs of the Contractor's head office personnel and overhead costs, any consequential, indirect or special damages, and any loss of profit or loss of opportunity costs and damages arising from or caused by such termination, regardless of whether any such excluded costs, damages or claims are made or incurred by

the Contractor or any Subcontractor or Supplier. The Owner shall not be liable for any other claims, costs or damages whatsoever arising from such termination of this Contract."

.23 GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

.1 Amend paragraph 7.2.3 as follows:

.1 Delete paragraphs 7.2.3.1 and 7.2.3.2;

.2 Amend paragraph 7.2.4 as follows:

.1 Delete "5" in the second line and replace with "10".

.3 Delete paragraph 7.2.5 and replace it with the following:

"7.2.5 If the default cannot be corrected within the 10 Working Days specified in paragraph 7.2.4, the Owner shall be deemed to have cured the default if it:

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

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

.3 completes the correction in accordance with such schedule.

.24 GC 9.1 PROTECTION OF WORK AND PROPERTY

.1 Add a new paragraphs 9.1.5 and 9.1.6 as follows:

"9.1.5 Without in any way limiting the Contractor's obligations under this GC 9.1, should the Contractor or any Subcontractor or Supplier cause loss or damage to property, including roads, buildings, structures, paving, grass, sod, trees or other plantings, whether owned by the Owner or others, and whether at the Place of the Work or adjoining it, the Contractor shall be liable for the cost of making good such damage and for the repair and any replacement cost of the grass, sod, trees or other plantings damaged, including the cost of any arborist or other consultant, and such costs may be deducted by the Owner from amounts otherwise owing to the Contractor. If there is no amount owing by the Owner to the Contractor at that time, then the Contractor shall reimburse the Owner for all of the said costs.

9.1.6 The Contractor shall be responsible for implementing all necessary security measures required to protect the areas of Work under his control and shall be responsible for damage which may arise from the failure of, or the failure to implement such security measures."

.25 GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

.1 Amend paragraph 9.2.3 as follows:

.1 Delete the words "The Owner" in the first line and replace them with "The Contractor".

.2 Add new paragraphs 9.2.5.5 and 9.2.5.6 as follows:

".5 take all reasonable steps necessary to mitigate or stabilize any conditions resulting from encountering toxic or hazardous substances, and

.6 take all necessary steps to mitigate the impact on Contract Time and Contract Price."

.3 Amend paragraph 9.2.7.3 by adding the following after the words "as a result of the delay" at the end:

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

of profit or loss of opportunity costs and damages arising from or caused by such delay, regardless of whether any such excluded costs, damages or claims are made or incurred by the Contractor or any Subcontractor or Supplier"

.4 Delete paragraph 9.2.7.4.

.5 Add new paragraphs 9.2.10 and 9.2.11 as follows:

"9.1.10 The Contractor shall, immediately upon becoming aware of any environmentally toxic and hazardous substance or materials (within the meaning of applicable environmental legislation), notify the Owner in writing setting out particulars concerning the type of the environmentally toxic and hazardous substance or materials, where it was discovered, and all other information that the Contractor has at the time of the notice.

9.1.11 The Contractor shall indemnify the Owner and its manager, officers, directors, employees, agents and elected officials in respect of any loss, costs, expense or fine which might be imposed in respect of any failure by the Contractor to satisfy its obligations under this GC 9.2 and, without limiting the general nature of this indemnity, the Contractor shall indemnify the Owner and its manager, officers, directors, employees, agents and elected officials in respect of any loss, costs, expense or fine if the Project is made subject to an order from a court or government agency requiring remediation of any contamination caused as a result of the Work performed by the Contractor or its Subcontractors or Suppliers."

.26 GC 9.5 MOULD

.1 Amend paragraph 9.5.2.3:

.1 Add the words "and for any delay" immediately before the comma near the end.

.2 Amend paragraph 9.5.3.3 by adding the following after the words "as a result of the delay" at the end:

", but excluding the costs of the Contractor's head office personnel and overhead costs, any consequential, indirect or special damages, and any loss of profit or loss of opportunity costs and damages arising from or caused by such delay, regardless of whether any such excluded costs, damages or claims are made or incurred by the Contractor or any Subcontractor or Supplier, and"

.27 GC 10.1 TAXES AND DUTIES

.1 Amend paragraph 10.1.1 as follows:

.1 Delete the words ..."at the time of closing except for Value Added Taxes"...and replace with the words ..."at the time of closing including Value Added Taxes"...

.2 Amend paragraph 10.1.2 by adding the following to the end:

"For greater certainty, the Contractor shall not be entitled to any mark-up for overhead or profit on any increase in such taxes and duties."

.28 GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

.1 Delete paragraph 10.2.2 and replace with the following:

"10.2.2 The Owner shall obtain and pay for development approvals, permanent easements, rights of servitude, and all necessary approval and permits, except for the permits and fees referred to in paragraph 10.2.3 or for which the Contract Documents specify as the responsibility of the Contractor.

.1 The Contractor shall apply for, obtain and pay for the building permit.".

.2 Amend paragraph 10.2.4 by adding the following to the end:
"The Contractor shall notify the Consultant and the chief building official or the registered code agency where applicable, of the readiness, substantial completion, and completion of the stages of construction set out in the applicable Building Code. The Contractor shall be present at each site inspection by an inspector or registered code agency. If any laws, ordinances, rules, regulations, or codes conflict, the more stringent shall govern."

.29 GC 11.1 INSURANCE

.1 Delete GC 11.1.1 in its entirety and replace it with the following:

"11.1.1 The Contractor shall obtain, maintain, pay for and provide to the Owner evidence of the insurance coverage required under this Contract. Any deductible and/ or self-insured retention are the responsibility of the Contractor and shall not constitute a Project expense chargeable back to the Owner in any way.

.1 Commercial General Liability Insurance

General liability insurance shall be maintained from the date of commencement of the *Work* until one year from the date of *Ready-for-Takeover*. Liability coverage shall be provided for completed operations hazards from the date of *Ready-for-Takeover*, as set out in the certificate of *Ready-for-Takeover*, on an ongoing basis for a period of 6 years following *Ready-for-Takeover*

Commercial General Liability, underwritten by an insurer licensed to conduct business in the Province of PEI, for a limit of not less than $5,000,000 per occurrence, an aggregate limit of not less than $10,000,000, within any policy year with respect to completed operations and a deductible of not more than $50,000. The insurance coverage shall not be less than the insurance provided by IBC Form 2100 and IBC Form 2320. The policy shall include an extension for a standard provincial and territorial form of non-owned automobile liability policy. This policy shall include but not be limited to:

.1 Name the Owner as an additional insured;
.2 Cross-liability and severability of interest;
.3 Blanket Contractual;
.4 Products and Completed Operations;
.5 Premises and Operations Liability;
.6 Personal Injury Liability;
.7 Contingent Employers Liability;
.8 Owners and Contractors Protective;
.9 Broad Form Property Damage;
.10 Firefighting Expenses;
.11 Elevator and Hoist Liability;
.12 Attached Machinery – while loading and unloading

The following also applies:

.13 If applicable to the *Project*, coverage shall include shoring, blasting, excavation, underpinning, demolition, pile driving,

caisson work and work below ground surface including tunneling and grading.

.14 If the Work involves asbestos removal, the policy shall provide coverage for this exposure.

.15 If the Work involves the use or operation of an owned or non-owned manned aircraft or watercraft, the policy shall provide coverage for this exposure.

.16 To achieve the desired limits, umbrella or excess liability insurance may be used.

.17 The Owner reserves the right to request in addition to Commercial General Liability Insurance coverage Wrap-up Liability. The Wrap-up shall be in the names of the Owner, Contractor, all Subcontractors, the Consultant and all other architects, engineers, consultants, planners and project managers. Limits and coverages shall comply with the requirements outlined above.

.2 Automobile Insurance

Standard Form Automobile Liability Insurance that complies with all requirements of the current legislation of the Province of PEI, having an inclusive limit of not less than $5,000,000 per occurrence for third party liability, in respect of the use or operation of vehicles owned operated or leased by the Contractor.

.3 Builders Risk Insurance

Broad Form Builders' Risk Insurance written in the joint names of the *Contractor, Owner*, *Subcontractors*, *Consultants*, and underwritten by an insurer licensed to conduct business in the Province of PEI. The policy shall have limits of not less than 1.1 times the *Contract Price*. Should the *Owner* provide any property to be incorporated into the *Project*, the policy must be endorsed to include the *Owner's* property. Coverage shall be maintained during the term of the *Contract* and until 10 calendar days after the date of *Ready-for- Takeover*.

The Builders' Risk shall:

.1 Be endorsed to grant permission to occupy prior to the completion or acceptance of the entire *Work*.

.2 Not be less that the insurance coverage provided by IBC Forms 4042 and 4047 or their equivalent replacement.

.3 Include the installation, testing, commissioning and subsequent use of any machinery and equipment including boilers, pressure vessels or vessels under vacuum.

.4 Apply to all *Products*, labour, equipment and supplies of every nature, the property of the *Owner* or *Contractor* or for which the *Owner* or *Contractor* may have assumed responsibility (whether on site or in transit), that is to be used in or pertaining to site preparation, erection, fabrication, construction or reconstruction of the structure.

.5 Be subject to a waiver of coinsurance.

.6 Include coverage for materials while in transit, awaiting installation or stored at off-site locations. Coverage shall be in an amount

equal to the value of the material.

7 Provide that in the case 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* for the purpose of adjusting the amount of such loss or damage payment with the insurer. 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* shall be entitled to a reasonable extension of *Contract Time*.

.4 Boiler and Machinery Insurance

The Boiler and Machinery Policy shall be written in the joint names of the *Contractor*, *Owner, Consultants* and *Subcontractors* and underwritten by an insurer licensed to conduct business in the Province of PEI. The policy limit shall equal the replacement value of all permanent or temporary boilers and pressure vessels and other insurable objects forming part of the *Work*. The *Contractor* may elect to carry the testing, commissioning and subsequent use of these objects under the Boiler and Machinery Policy.

.5 Contractor's Equipment Floater

The *Contractor* shall provide and maintain coverage all equipment used on the *Project* during the term of this *Contract*. Coverage will be provided, on a broad form basis, for construction machinery, equipment, tools and stock that will be used by the *Contractor* in the performance of the *Work.* The coverage will also include rental expense. Coverage is to be carried from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.

.6 Contractor's Pollution Liability

The Contractor shall carry a Contractor's Pollution Liability Policy, underwritten by an insurer licensed to conduct business in the Province of PEI for a limit of not less than $2,000,000. Coverage shall include bodily injury, property damage, clean-up and remediation costs

.7 Proof of Insurance

.1 The *Contractor* shall provide the *Owner* with an executed certificate of insurance and a renewal replacement as may be necessary, stating any pertinent exclusions as applicable contained in the policies which may affect coverage as outlined in this *Contract*. The certificate will be delivered prior to the commencement by the *Contractor* of the *Work* or upon renewal of the policy. The *Contractor's* insurance carriers and the insurance policy provisions must be acceptable to the *Owner*. All lines of coverage required by this *Contract* must be shown on the certificate of insurance. The *Contractor* will make available complete certified copies of all applicable insurance policies for examination if required by the *Owner*.

.2 The *Contractor* shall ensure that each *Subcontractor* requires adequate insurance in accordance with the work being performed

under the terms of their engagement. It is the *Contractor's* responsibility to ensure this exposure is insured adequately and at no time will costs associated with this exposure be transferred to the *Owner*.

.3 Delivery to and examination or approval by the *Owner* of any certificates of insurance or policies of insurance or other evidence of insurance shall not relieve the *Contractor* of any of its indemnification or insurance obligations under this *Contract*. The *Owner* shall be under no duty to either ascertain the existence of or to examine such certificate of insurance or policies of insurance or to advise the *Contractor* in the event that such insurance coverage is not in compliance with the requirements set out in this *Contract*. The *Contractor* is responsible for ensuring such compliance.

.4 All policies of insurance shall:

.1 Be recorded as being a primary policy and shall be in a form and issued by an insurance company satisfactory to the *Owner* and that is licensed to carry on business in PEI;

.2 Be maintained continuously during the course of the *Work* or for such period of time as may be required after completion of the *Work* as may be deemed necessary by the *Owner*;

.3 The *Contractor* shall ensure that any self-insured and deductible limits are prudent and responsible for the type of work being undertaken under the *Contract*. Any and all claim costs are borne by the *Contractor* including, but not limited to, deductibles, adjusting fees, legal costs, disbursements, and settlements;

.4 Ensure that, except in the case of automobile liability insurance, non-owned automobile liability insurance, the *Owner* and the *Consulta*nt is to be added to the policy as an additional insured and/or loss payee;

.5 Contain a cross-liability and severability of interest provisions, as may be applicable;

.6 Provide that at least thirty (30) days prior written notice, fifteen (15) days in the case of automobile liability insurance, and ten (10) days in the event of non- payment of premiums, shall be given to the *Owner* by the insurer before the insurer or the *Contractor* takes any steps to cancel, terminate, fail to renew, amend or otherwise change or modify the insurance or any part thereof.

.7 Necessary notification to insurers is required to ensure continuous coverage is in place at all times. This will include, but is not limited to, transfer of coverage from one policy to another (i.e. completion of a building constructed under a Builder's Risk Policy being transferred to a Property policy once *Ready-for-Takeover* has been achieved)."

.2 Delete paragraph 11.1.2 in its entirety and replace it with the following:

"11.1.2 The Contractor shall not commence work under this contract until he has obtained all of the liability insurance specified and such insurance has been approved by the Owner, nor shall the Contractor allow any subcontractor to commence work on his sub-contract until all similar insurance required of the sub-contractors has been obtained. Approval of the insurance by the Owner shall not relieve or decrease the liability of the Contractor hereunder nor shall such approval imply the contractor has fulfilled all the terms and conditions of this Contract. Upon expiration of any policies during the period of this Contract, new Certificates of Insurance showing renewal shall be forwarded. In the event, that the Contractor carried a blanket-type policy, an endorsement by the insurance company is required confirming coverage of this specified project and indicating the extent of coverage.

.3 Amend paragraph 11.1 by adding paragraphs 11.1.9 and 11.1.10 as follows:

"11.1.9 Indemnity/Hold Harmless:

.1 The Contractor shall be liable for all injuries to persons and for damage to property caused by his operations, and those of his sub-contractors, and his and their employees, engaged on all operations in connection with the contract both on and off the site, and he shall indemnify and save harmless the Owner from all suits, claims, expenses, costs, demands, losses and damages to which the Owner may be put to reason of injury including death, to persons, and damages to property of the Owner and others, resulting from negligence, carelessness and any other cause whatsoever in the performance of the work.

.2 The Contractor shall, until the date of issue of the final Certificate of Approval of the work by the Consultant, indemnify and save harmless the Owner, and protect his own interests against:

.1 Theft, burglary or robbery of, and loss or damage to, all materials and equipment brought to the site for use in the work, whether or not such material and equipment are incorporated in the work at the time that any such theft, burglary, robbery, loss or damage occurs.

.2 Theft or burglary of, and loss or damage to, any of his own plant and equipment being used on the project and/or stored on the site.

11.1.10 In all insurance policies required under this agreement:

.1 There shall be an endorsement stating that the insurer will provide 30 days' notice to the Province's Risk Manager (or the acting or assistant) of cancellation or material change in coverage;

.2 The insurer shall acknowledge that the policy is primary and any other insurance policies that may be in effect or any other sources of recovery including the Government of Prince Edward Island's Self Insurance and Risk Management Fund shall not contribute in any way to any judgments, awards, payments, or costs or expenses of any kind whatsoever made as a result of actual or alleged claims. The Ultimate Recipient shall provide the Province with current certificates of insurance, in a form and content reasonably

acceptable to the Province, evidencing the required insurance policies hereunder within 10 days of the Effective Date and on each renewal of the insurance policies thereafter. Umbrella insurance may be used to achieve the required insured limits above."

.30 GC 12.1 READY-FOR-TAKEOVER

.1 Delete paragraphs 12.1.1.4 and 12.1.1.5 and replace them with the following:

".4 The delivery to the *Owner* of guarantees, warranties, certificates, testing and balancing reports and spare parts, distribution system diagrams, *Shop Drawings*, maintenance and operating manuals, instructions, samples, existing reports and correspondence from authorities having jurisdiction, and all other close-out materials or documents specified in the *Contract*.

.5 The delivery to the *Owner* of the final *As-Built Drawings*."

.2 Add new paragraph 12.1.1.9 as follows:

".9 Confirmation by the *Consultant* that the aggregate cost of completing the remaining *Work* and correcting known defects and deficiencies is the lesser of $5,000 and 1% of the *Contract Price*."

.3 Delete paragraph 12.1.2 and replace with the following:

"12.1.2 If any prerequisites set forth in paragraphs 12.1.1.3 to 12.1.1.6 are deferred by agreement between the *Owner* and the *Contractor*, *Ready-for-Takeover* shall not be delayed."

.4 Delete paragraph 12.1.6 in its entirety.

.31 GC 12.2 EARLY OCCUPANCY BY THE OWNER

.1 Delete paragraphs 12.2.1 through 12.2.4 and replace them with the following:

"12.2.1 The *Owner*, its agents, and *Other Contractors* shall have the right to enter, occupy and take possession of any portion or all of the undelivered portion of the *Project*, even though *Ready- for-Takeover* may not have been attained, provided that such entry, occupation, taking of possession or use will not interfere, in any material way, with the progress of the *Work*.
The entry, occupation, taking of possession or use of any such portion of the *Project* or *Work* shall not be deemed to be the *Owner's* acknowledgement or acceptance of the *Work* or the *Project,* nor shall it be deemed to be an acknowledgement or acceptance by the *Owner* that such *Work,* or portions of the *Work,* have met the *Ready-for-Takeover* requirements described in the *Contract Documents*.

12.2.2 The *Contractor* shall, as directed by the *Consultant*, give priority to certain parts of the *Work* and bring such parts to a "ready for use" status. Such instructions may require installation of temporary stairs and exits and temporary services, all of which shall be provided and subsequently removed.

12.2.3 The *Contractor* shall maintain full access to the *Work* for the *Owner*'s use, as required. The *Contractor* shall maintain or restore heat and power to areas when necessary or as scheduled and keep existing utilities and services functional.

12.2.4 The entry, occupation, taking of possession or use of any portion of the *Project* by the *Owner*, its agents or *Other Contractors* pursuant to this GC

12.2 – EARLY OCCUPANCY BY THE OWNER shall not relieve the *Contractor* of any of its obligations under the *Contract* , including the *Contractor's* designation and obligations as "constructor" under *OHSA* and the *Contractor's* obligations respecting construction health and safety, and all the *Contractor's* obligations, rules, regulations and practices shall continue to apply notwithstanding such entry, occupation, taking of possession or use."

.32 GC 12.3 WARRANTY

.1 Amend paragraph 12.3.1 by adding the following to the end:
"Notwithstanding the foregoing, if an item of Work is not completed at Ready-for-Takeover, except for extended warranties as described in paragraph 12.3.6, the warranty period for such item of Work shall be one year from the date that such item of Work has been completed and accepted in writing by the Owner."

.2 Add a new paragraph 12.3.1A as follows:
"12.3.1A If the Contractor has been permitted to make use of permanent equipment or systems, as provided in GC 3.12 – CONTRACTOR'S USE OF PERMANENT EQUIPMENT OR SYSTEMS, such permanent equipment or system shall be subject to the same warranty as described in this GC 12.3 and shall be judged, for purposes of assessing compliance with the warranty, as though the equipment or system was new, clean and unused by the Contractor, except for normal commissioning and start-up activities, prior to Ready-for-Takeover."."

.3 Amend paragraph 12.3.4 by adding the following to the end:
"The Contractor shall perform all remedial and warranty work at its own cost and expense and at a time convenient to the Owner, which may be outside of normal working hours. Before performing the remedial and warranty work the Contractor shall provide, for the Owner's review and approval, a proposed schedule for the performance of such work. Except for any extended warranties provided for in the Contract Documents, the warranty period for any corrective work performed by the Contractor pursuant to GC 12.3 – WARRANTY shall commence on the date that such corrective Work was completed."

.4 Add new paragraphs 12.3.5A and 12.3.5B immediately after paragraph 12.3.5 as follows:
"12.3.5A If the *Contractor* fails to perform the remedial and warranty work and/or fails to correct the defects, deficiencies or items of non-compliant *Work* or is not diligently working towards completion of the same to the satisfaction of the *Consultant*, or if the *Contractor* fails to correct or pay for damage resulting from corrections made, as required in paragraph 12.3.5, the *Owner* may engage others to perform the work necessary to complete and correct the outstanding defects, deficiencies or items of non-compliant *Work* at the risk and cost of the *Contractor*, and may deduct such costs and may pay such costs and damage from the *Deficiency Rectification Security*. If the costs of completion and correction of such defects, deficiencies and/or non-compliant *Work* exceed the amount of the *Deficiency Rectification Security*, the *Contractor* shall reimburse the *Owner* for all excess costs and damages. The *Owner's* rights under this

paragraph are in addition to any other rights the *Owner* may have pursuant to the *Contract* and/or at law.

12.3.5B Provided that the *Contractor* has completed all outstanding remedial and warranty work and has corrected all defects and deficiencies and has completed all items of non-compliant *Work* and has corrected or paid for all damage resulting from corrections made, all to the satisfaction of the *Consultant*, the *Owner* shall return to the *Contractor* the balance of the *Deficiency Rectification Security*, if any, without interest, 10 *Working Days* after the date that is the later of (a) the date of total completion of the *Contract*, and (b) the date on which the warranty period ends."

.33 GC 13.1 INDEMNIFICATION

.1 Delete GC 13.1 and replace it with the following:

"GC 13.1 INDEMNIFICATION

13.1.1 The Contractor shall indemnify and shall defend and save harmless the Owner, its manager, officers, directors, agents, representatives, elected officials, successors, and employees harmless from and against any claims, causes of action, demands, losses, charges, fees, duties, accounts, fines, penalties, expenses and costs (including legal costs on a solicitor and client basis), or other proceedings of every kind or nature whatsoever at law or in equity brought against, suffered by, or imposed on the reason of,

.1 the Contractor carrying out or failing to carry out any obligation to which it is subject including the performance of the Work, or exercising any right to which it is entitled, under the Contract except to the extent that the same are caused by the negligence or deliberate wrong-doing of the Owner or other person entitled to indemnification under this section, or

.2 any patent, trademark, copyright infringement or other breach of any intellectual property right of any person, for which the contractor or any Subcontractor to the Contractor is responsible.

13.1.2 The Contractor shall indemnify and hold harmless the Owner's agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings by third parties that arise out of, or are attributable o, the Contractor's performance of the Contract, provided such claims are attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property, and caused by negligent acts or omissions of the Contractor or anyone for whose acts the Contractor may be liable, and made in writing within a period of 6 years from the date of Ready-for-Takeover as set out in the certificate of Ready-for- Takeover, or within such shorter period as may be prescribed by any limitation statute or the province or territory of the Place of the Work."

.34 PART 14 – OTHER PROVISIONS

.1 Add a new "**PART 14 – OTHER PROVISIONS**" as follows:

"PART 14 OTHER PROVISIONS

GC 14.1 LIENS AND ACTIONS

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

14.1.2 If a lien action is commenced arising out of a lien described in paragraph 14.1.1, the *Contractor* shall take all reasonable steps to remove the *Owner* from such action and shall indemnify the *Owner* and hold it harmless in such action.

14.1.3 All amounts, including legal costs on a full indemnity basis, disbursements, interest, borrowing, premium or other bonding costs and/or charges incurred by the *Owner* in releasing, vacating, discharging and/or otherwise dealing with a *Subcontractor* or *Supplier* lien, written notice of a lien and/or defending or otherwise dealing with a lien action, shall be charged to the *Contractor* and shall be set off and deducted from any amount owing to the *Contractor*. If there is no amount owing by the *Owner* to the *Contractor* at that time, then the *Contractor* shall reimburse the *Owner* for all amounts incurred by the *Owner*.

GC 14.2 CONTRACTOR'S DISCHARGE OF LIABILITIES

14.2.1 In addition to the obligations assumed by the *Contractor* pursuant to GC 3.6 – SUBCONTRACTORS AND SUPPLIERS, the *Contractor* agrees to discharge all liabilities incurred by it for services, materials, *Subcontractors* and *Products*, used or reasonably required for use in the performance of the *Work*, except for amounts withheld by reason of legitimate dispute and which have been identified to the party or parties, from whom payment has been withheld.

GC 14.3 OWNERSHIP OF MATERIALS

14.3.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work and Products* delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner*. The *Contractor* shall remove all surplus or rejected materials from the *Place of the Work*.

GC 14.4 DAILY REPORTS/DAILY LOGS

14.4.1 The *Contractor* shall cause its supervisor, or such competent person as it may delegate, to prepare and maintain a daily site log with descriptions of Project activities. Make available to *Owner* for inspection and copying all of the records.

GC 14.5 ADVERTISING AND PUBLIC STATEMENTS

14.5.1 The *Contractor* shall not publish, issue or make any statements or news release, electronic or otherwise, concerning the *Contract*, the *Work*, or the *Project*, and shall not use the *Owner's* name, logo, etc. without the prior express written consent of the *Owner*."

END OF SECTION

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1 General

1.1 SCOPE OF WORK

.1 The Contractor is to provide each item, and properly execute all work as specified herein, indicated by drawings, addenda, or change orders issued with respect to this project.

.2 The Contractor shall coordinate, administer, and supervise all work, material acquisition and labour.

.3 The project involves the construction / renovation of the select area within the building at 98 Water Street located in Summerside, PE.

.1 Temporary heating will be required at Contractors cost when mechanical units are removed from the roof.

.2 All roof work shall be completed by Flynn. Flynn is currently doing a re-roof of the area as a subcontractor to Garland Construction Inc.

.3 Contact Neil Stanley with Garland Construction Inc. at 902-989-7109; nstanley@garlandcanada.com. Daniel Morris is to be cc'd on all correspondence once construction starts.

1.2 WORK BY OTHERS

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

.2 Schedule the Work of this Contract in consultation and cooperation with the Work of other Contractors and/or Owners own forces to produce a coordinated construction schedule.

1.3 COORDINATION

.1 All Trades on site are responsible to co-operate and co-ordinate with each other.

.2 Coordination prior to installation of all building components is mandatory.

.3 Where work must be modified or reinstalled to be properly coordinated, the cost to do so will be paid by the Trades involved. The Owner will not pay for uncoordinated work nor will the Owner pay to resolve uncoordinated work.

.4 If resolution cannot be achieved among the involved Trades, the Contractor and Consultant will assess Trade involvement and assign costs accordingly.

1.4 DAMAGE

.1 Where damage is done to work in progress or existing areas of the building and is unclaimed by a Trade, the cost to repair the damage will be assessed by the Consultant and assigned on a pro-rated tender cost basis to all Trades on site at the time the damage occurred.

.2 The Owner will not participate in paying for such damage.

1.5 DEDUCTIONS FOR UNCORRECTED WORK

.1 If, in the opinion of the Consultant, it is not expedient to correct defective work or work not done in accordance with the Contract documents, the Owner may deduct from the Contract price the difference in value between the work as done and that called for by the Contract, the amount of which shall be determined in the final instance by the Consultant.

1.6 CORRECTION AFTER COMPLETION

.1 Subject to any special provisions in the Contract documents, the Contractor shall remedy any defects due to faulty materials or workmanship appearing within a period of one year from the date of substantial completion of the work and shall pay for any damage to other work resulting there from which appears within such period and neither the final certificate nor payment there under shall relieve the Contractor from responsibility hereunder. The Owner shall give notice of observed defects promptly.

1.7 EMERGENCIES

.1 The Consultant has authority in an emergency to stop the progress of the work whenever in his or her opinion, such stoppage may be necessary to ensure the safety of life, or of the structure, or neighbouring property. This includes authority to make such changes and to order, access and award the cost of such work extra to the Contract or otherwise as may in his or her opinion be necessary.

1.8 WORK SEQUENCE

.1 Construct Work to accommodate Owner's continued use of existing premises during construction.

.2 Coordinate Progress Schedule referred to in Section 01 32 16 - Construction Progress Schedule and coordinate with Owner Occupancy during construction.

.3 Construct Work to provide for continuous public usage. Do not close off public usage of facilities.

.4 Maintain fire access/control.

1.9 PARTIAL OWNER OCCUPANCY

.1 Schedule and complete designated portions of Work for Owner's occupancy prior to Substantial Performance of entire Work. There will only be one substantial performance.

.2 Consultants and the Authority Having Jurisdiction will have to review and sign off on the areas being sequentially provided for owner's occupancy.

.3 Execute Certificate of Substantial Performance for each designated portion of Work prior to Owner occupancy. Contractor shall allow:

- .1 Access for Owner personnel.
- .2 Use of parking facilities.
- .3 Operation of HVAC and electrical systems.

.4 On occupancy, Owner will provide for occupied areas:

- .1 Operation of HVAC and electrical systems.
- .2 Maintenance.
- .3 Security.

1.10 EXECUTION

.1 Execute work with least possible interference or disturbance to building operations, public and normal use of premises.

1.11 MITIGATION OF IMPACT ON EXISTING BUILDING

.1 This Contractor will recognize that the existing facility must remain fully functional with minimal disruption during the course of the Work, and that the existing facility, its operation, and its occupants may be very sensitive to dirt, dust, air-borne particulate, smoke, fumes, etc. generated as a result of the Work. Any disruption in services must be brought to the attention of the Consultant and receive prior approval before commencement.

.2 This Contractor is responsible to ensure that the existing building is kept free from any contamination that may result from any of the Work.

.3 The life safety and security systems in the existing building are required to remain functional during construction. This Contractor is responsible to ensure that such systems are not inadvertently activated or deactivated during construction.

.4 The Contractor is financially responsible for all measures required to minimize the potential for any contamination that could occur. Such measures include, but are not limited to, temporarily masking sensors in non-occupied areas, providing fans, working off hours (nights), performing work outside, sealing off localized work areas, etc. All such measures to be confirmed and approved by the Consultant prior to undertaking.

.5 The scheduling of all Work, which has the potential to cause contamination to the existing building, is to be approved by the Owner.

.6 This Contractor is responsible to immediately mitigate any discomfort, disruption, damage or condition, to the existing occupants, operations, space or building systems as deemed necessary by the Consultant.

1.12 DOCUMENTS

.1 The Contract Documents are complementary and what is called for by any one shall be as binding as if called for by all.
.2 Descriptions of materials or work which have well known technical or trade meanings shall be held to refer to such recognized standards.
.3 Should the specifications conflict with the drawings, the specifications shall govern.
.4 In the case of discrepancies between drawings, those of larger scale, or if the scale are the same, those of later date shall govern.
.5 All drawings and specifications shall be interpreted in conformity with the agreement.

1.13 PROTECTION OF WORK AND PROPERTY

.1 The Contractor shall maintain continuously adequate protection of all their work from damage and shall take reasonable precautions to protect the Owner's property from all injury arising in connection with this Contract. The Contractor shall make good any damage or injury to their work and shall make good any damage or injury to the property of the Owner resulting from the lack of reasonable protective precautions. The Contractor shall not be responsible, however, for any damage or injury to their work and to the property of the Owner which may be directly due to errors in the Contract documents or caused by the Owner, their agents, or employees, or from any work or risk which the Owner has agreed to insure, provided the Contractor has taken reasonable protective precautions. The Contractor shall adequately protect adjacent property as required by law and the Contract documents.

1.14 COMMUNICATION

.1 All submissions and inquiries shall be directed to the Consultant for review.
.2 All direction will be transmitted to the Contractor by the Consultant.

1.15 CODES AND REGULATIONS

.1 Perform work in accordance with National Building Code of Canada (NBC) 2020 and any other code of provincial or local application, provided that in any case of conflict or discrepancy the more stringent requirements shall apply.
.2 Meet or exceed requirements of contract documents and specified standards.
.3 References to standards, including manufacturer's direction for installation shall be the latest edition.
.4 All materials, components and equipment as well as construction methods shall comply with the NBC (2020) and all other applicable Provincial codes or regulations.
.5 The latest edition of the Canadian Electrical Code shall govern all electrical work, whether pre-wired and/or assembled remote from the site or not.
.6 All equipment supplied or installed shall be CSA approved for the intended use.
.7 The latest edition of the PEI Occupational Health and Safety Act and Regulations shall govern safe construction practices.
.8 Provide a copy of all certificates of acceptance issued by Provincial or local authorities.

1.16 CONTRACTOR'S USE OF SITE

.1 Do not unreasonably encumber site with materials or equipment.
.2 Move stored products or equipment, which interfere with operations of Consultant or other Contractors.
.3 Obtain and pay for use of additional off site storage or work areas needed for operations.
.4 The work related to modifying the site roadways must be carried out so that one half of the roadway is open to vehicle traffic at all times.

1.17 SITE INSPECTOR

.1 No work is to be covered without having received approval from the Consultant. The Consultant will have the authority to cause any part of the work to cease, should, in his or her opinion, there be cause to do so.

.2 This work shall be examined by the Consultant and approval granted to resume when a satisfactory solution has been found out.

.3 The Owner does not have authority to authorize changes to work. He or she shall confer with the Consultant who, if necessary will authorize any change.

.4 The fact that the Owner or Consultant does not reject any work shall not remove the responsibility for completing all work as specified from the Contractor.

1.18 SETTING OUT OF WORK

.1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations.

.2 Provide all equipment, materials and devices needed to lay out and construct work.

.3 Supply such devices as straight edges and templates required to facilitate Consultant's inspection of work.

1.19 CONCEALMENT

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

1.20 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Consultant of impending installation and obtain his approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.

1.21 CUTTING, FITTING AND PATCHING

.1 Execute cutting, core drilling, fitting and patching, required to install and make new work under this contract fit properly.

.1 Includes all cutting and patching in building for connection of new mechanical and electrical services to service lines.

.2 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.

1.22 BLOCKING AND BACKING

.1 Provide all blocking, backing, hangers, etc. used for support of all built-in work.

1.23 EXISTING SERVICES

.1 Before commencing work, establish the location and extent of service lines and notify Consultant of findings if in conflict with information or intent shown.

.2 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.3 Contractor shall pay for any or all repairs to existing services that have been damaged due to the Contractor's negligence in the course of his work.

.4 Notify Consultant and utilities of intended interruption of services and obtain permission.

.5 Where Work involves breaking into or connecting to existing services, give Consultant two weeks notice for necessary interruption. Minimize duration of interruptions. Carry out Work at times as directed by governing authorities or Owner with minimum disturbance.

.6 Provide temporary services when directed by Consultant to maintain critical building and tenant systems.
.7 Provide alternative routes for personnel and vehicular traffic.
.8 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
.9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by Authorities Having Jurisdiction.
.10 Record locations of maintained, re-routed and abandoned service lines.
.11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.24 ACCESS AND SECURITY

.1 Access and security on the entire job site will be the responsibility of the Contractor.

1.25 ADDITIONAL DRAWINGS

.1 The Consultant may furnish as necessary for the execution of the work, additional instructions, by means of drawings or otherwise. All such additional instructions shall be consistent with the contract documents. In giving such additional instructions the Consultant shall have authority to make minor changes in the work, consistent with the Contract.

1.26 RELICS AND ANTIQUITIES

.1 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found during the work, shall remain property of the Owner. Protect such articles and request directives from Consultant.
.2 Give immediate notice to Consultant if evidence of archaeological finds are encountered during construction, and await Consultant's written instructions before proceeding with work in this area.

END OF SECTION

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1 General

1.1 ACCESS AND EGRESS

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

1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Consultant to facilitate work as stated.
.2 Maintain existing services to building and provide for personnel and vehicle access.
.3 Where security is reduced by work provide temporary means to maintain security.
.4 Contractor will provide sanitary facilities for use by Contractor s personnel. Keep facilities clean.
.5 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to public, building operations, occupants, and normal use of premises. Arrange with Consultant to facilitate execution of work.

1.4 EXISTING SERVICES

.1 Notify, Consultant and utility companies of intended interruption of services and obtain required permission.
.2 Where Work involves breaking into or connecting to existing services, give Consultant two weeks of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
.3 Provide for personnel, pedestrian and vehicular traffic.
.4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.5 SPECIAL REQUIREMENTS

.1 Carry out noise generating Work Monday to Friday and Weekends from 07:00 to 17:00 hours.
.2 Submit schedule in accordance with Section 01 32 16 - Construction Progress Schedule.
.3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
.4 Keep within limits of work and avenues of ingress and egress.
.5 Deliver materials outside of peak traffic hours, coordinate times with Owner.

1.6 SECURITY

.1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

1.7 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted on property.

END OF SECTION

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1 General

1.1 REFERENCES

.1 Owner/Contractor Agreement.
.2 Canadian Construction Documents Committee (CCDC).
  .1 CCDC 2-2020, Stipulated Price Contract.
.3 Section 00 73 00 - Supplementary Conditions.

1.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Make applications for payment on account as provided in Agreement as Work progresses.
.2 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.
.3 Submit to Consultant, at least 14 days before first application for payment, Schedule of Values for parts of Work, aggregating total amount of Contract Price, so as to facilitate evaluation of applications for payment.

1.3 SCHEDULE OF VALUES

.1 Make schedule of values out in such form and supported by such evidence as Consultant may reasonably direct and when accepted by Consultant, be used as basis for applications for payment.
.2 Include statement based on schedule of values with each application for payment.
.3 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Consultant may reasonably require to establish value and delivery of products.
.4 Provide, minimum 14 days before submitting first application for payment, a Schedule of Values, aggregating the Total Contract Price. After approval by the Consultant the Schedule of Values will be used as a basis for the application for progress payments.
.5 Contractor shall submit with the Schedule of Values, an itemized list of all trades and applicable labour rates for each, which will be used as a basis for labour rates in changes to contract Work.
.6 The schedule of values is to indicate separate line items each for mechanical commissioning, electrical commissioning, mechanical operation & maintenance manuals and electrical operations ' maintenance manuals.

1.4 PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS

.1 Submit separate Schedule of Unit Price items of Work requested in Bid form.
.2 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:
  .1 Cost of material.
  .2 Delivery and unloading at site.
  .3 Sales taxes.
  .4 Installation, overhead and profit.
.3 Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

1.5 PROGRESS PAYMENT

.1 Consultant will issue to Owner, no later than ten days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Consultant determines to be properly due. If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

1.6 SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to Section 00 73 00 - Supplementary Conditions.

.2 Prepare and submit to Consultant comprehensive list of items to be completed or corrected and apply for a review by Consultant to establish Substantial Performance of Work or substantial performance of designated portion of Work when Work is substantially performed if permitted by lien legislation applicable to Place of Work designated portion thereof which Owner agrees to accept separately is substantially performed. Failure to include an item on list does not alter responsibility to complete Contract.

.3 No later than ten days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than seven days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.

.4 Consultant shall state date of Substantial Performance of Work or designated portion of Work in certificate.

.5 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Consultant, establish reasonable date for finishing Work.

1.7 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

.1 After issuance of certificate of Substantial Performance of Work:

.1 Submit an application for payment of holdback amount.

.2 Submit sworn statement that all accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in any way be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.2 After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of holdback amount.

.3 Where holdback amount has not been placed in a separate holdback account, Owner shall, ten days prior to expiry of holdback period stipulated in lien legislation applicable to Place of Work, place holdback amount in bank account in joint names of Owner and Contractor.

.4 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Owner may retain out of holdback amount any sums required by law to satisfy any liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Owner.

1.8 FINAL PAYMENT

.1 Submit an application for final payment when Work is completed.

.2 Consultant will, no later than ten days after receipt of an application for final payment, review Work to verify validity of application. Consultant will give notification that application is valid or give reasons why it is not valid, no later than seven days after reviewing Work.

.3 Consultant will issue final certificate for payment when application for final payment is found valid.

END OF SECTION

1 General

1.1 APPOINTMENT AND PAYMENT

.1 The Contractor will arrange and pay for the services of an independent Consultant to carry out the following tests:
  .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  .2 Inspection and testing performed exclusively for Contractor's convenience.
  .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
  .4 Mill tests and certificates of compliance.
  .5 Tests specified to be carried out by Contractor under the supervision of Consultant.
  .6 Additional tests specified in Article 1.3.7 below.
  .7 Where tests or inspections reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as Consultant may require to verify acceptability of corrected work.

1.2 CONTRACTOR'S RESPONSIBILITIES - GENERAL

.1 Provide labour, equipment and facilities to:
  .1 Provide access to Work for inspection and testing.
  .2 Facilitate inspections and tests.
  .3 Make good Work disturbed by inspection and test.
  .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
.2 Notify Consultant sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
.4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Consultant.
.5 Provide Consultant with one (1) PDF of fully documented test reports, submitted immediately following the testing operations.

1.3 FINAL REPORT

.1 Submit to the Owner at completion of job, two bound hard copies and one electronic copy of inspection report. This report to include:
  .1 All copies of test results, indexed to correspond with testing requirements of this Section.
.2 Written report from the testing firm carrying out the work of this Contract stating that the work as itemized under Par. 4 of this Section has been performed in strict accordance with the requirements of the Contract documents.
.3 The report will be signed and sealed by a Professional Engineer registered to practice in the Province of Prince Edward Island and practicing in the field of materials testing.

END OF SECTION

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1 General

1.1 GENERAL

.1 Schedule and administer project meetings throughout the progress of the work.
.2 Prepare agenda for meetings.
.3 Distribute written notice of each meeting four (4) days in advance of meeting date to Consultant.
.4 Provide physical space and make arrangements for meetings.
.5 Preside at meetings.
.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
.7 Reproduce and distribute copies of minutes within three (3) days after meetings and transmit to meeting participants.
.8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

.1 Within fifteen (15) days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
.2 Consultant, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
.3 Establish time and location of meeting and notify parties concerned minimum five (5) days before meeting.
.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
.5 Agenda to include:
    .1 Appointment of official representative of participants in the Work.
    .2 Schedule of Work: in accordance with Section 01 32 16 - Construction Progress Schedule.
    .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
    .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
    .5 Delivery schedule of specified equipment in accordance with Section
    .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
    .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
    .8 Owner provided products.
    .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
    .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
    .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
    .12 Monthly progress claims, administrative procedures, photographs, hold backs.
    .13 Appointment of inspection and testing agencies or firms.
    .14 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work and not less than bi-weekly.
.2 Contractor, major Subcontractors involved in Work, Consultant, Owner are to be in attendance.
.3 Notify parties concerned minimum five (5) days before meeting.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within

.5 Agenda to include the following:

- .1 Review, approval of minutes of previous meeting.
- .2 Review of Work progress since previous meeting.
- .3 Field observations, problems, conflicts.
- .4 Problems which impede construction schedule.
- .5 Review of off-site fabrication delivery schedules.
- .6 Corrective measures and procedures to regain projected schedule.
- .7 Revision to construction schedule.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for affect on construction schedule and on completion date.
- .12 Other business.

END OF SECTION

1 General

1.1 DEFINITIONS

.1 Activity: An element of Work performed during course of Project. An activity normally has an expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart). A graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: Original approved plan (for Project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: Number of work periods (not including holidays or other nonworking periods) required to complete an activity or other Project element. Usually expressed as workdays or workweeks.

.6 Master Plan: A summary-level schedule that identifies major activities and key milestones.

.7 Milestone: A significant event in Project, usually completion of major deliverable.

.8 Project Schedule: The planned dates for performing activities and the planned dates for meeting milestones. A dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: Overall system operated by Consultant to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately ten working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Ten (10) working days after award of contract and prior to commencement of Work, submit to Consultant the following work management documents:

- .1 Work Schedule as specified herein. Work Schedule to include a critical path methodology.
- .2 Shop Drawing Submittal Schedule specified in Section 01 33 00 - Submittal Procedures.
- .3 Health and Safety Plan specified in Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.4 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Consultant will review and return revised schedules within five working days.

.3 Revise impractical schedule and resubmit within five working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

.1 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

- .1 Award.
- .2 Shop Drawings, Samples.
- .3 Permits.
- .4 Mobilization.
- .5 Excavation.
- .6 Geothermal work
- .7 Asphalt
- .8 Exterior cladding and roofing.
- .9 Interior Architecture (Walls, Floors and Ceiling).
- .10 Plumbing.
- .11 Lighting.
- .12 Electrical.
- .13 Piping.
- .14 Controls.
- .15 Heating, Ventilating, and Air Conditioning.
- .16 Testing and Commissioning.
- .17 Supplied equipment long delivery items.
- .18 Owner supplied equipment required dates.
- .19 Substantial Completion.
- .20 Deficiency Completion.
- .21 Total Completion.

1.6 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule every month, reflecting activity changes and completions, as well as activities in progress. Provide two days before construction meeting for the project duration.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

.3 Provide a two week look ahead schedule noting detailed tasks to be completed. Update on a weekly basis and circulate via email every Friday.

1.7 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site / construction meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures are to be identified and are the contractors responsibility.

END OF SECTION

1 General

1.1 GENERAL

.1 All submittals are to be delivered within 30 days of award of Contract.

.2 Make specified submittals to the Consultant at commencement of Contract, before beginning work on site (and no later than ten days after award). Include:

- .1 Contract Security
- .2 Proof of Insurance
- .3 Workers' Compensation clearance letter
- .4 Cost Breakdown
- .5 Permits as required
- .6 Construction schedule
- .7 Corporate Safety Plan
- .8 Site specific safety plan
- .9 Shop drawing schedule

.3 During Construction provide:

- .1 Updated construction schedule
- .2 Shop drawings as required
- .3 Inspection and test reports
- .4 Request for Information
- .5 Submission required for payment purposes

.4 At completion of Work provide

- .1 Submission at completion of work as specified in Project Close Out, Commissioning, and Operations and Maintenance Data Sections.

1.2 ADMINISTRATIVE

.1 Refer to CCDC 2-2020 GC 3.8 Shop Drawings.

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

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

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

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

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

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

.8 Verify field measurements and affected adjacent Work are coordinated.

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

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

.11 Keep one reviewed copy of each submission on site.

1.3 SUBMITTAL SCHEDULES:

.1 Within ten days following award of contract, prepare and submit a summary of all submittals required by the Trade Package.

.2 Submittal schedule shall be formatted as follows:

SECTION NUMBER	ITEM / EQUIP	SHOP DWG DELIVERY DATE	ORDER DATE	ITEM DELIVERY DATE

.3 The initial submission shall include completion of the first three columns of the above table example. Once approved shop drawings are received by the Contractor, the balance of the summary shall be updated and submitted accordingly.

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

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

.3 Allow ten days for Consultant's review of each submission.

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

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

.6 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.7 After Consultant's review, distribute copies.

.8 Submit digital copy of all shop drawings, product data sheets, reports, MSDS sheets and other traditional paper submissions.

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

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

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
.2 Testing must have been within 3 years of date of contract award for project.

.11 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Consultant.
.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
.2 Certificates must be dated after award of project contract complete with project name.

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

.13 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.
.1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.14 Submit two hard copies of Operation and Maintenance Data for requirements requested in specification Sections, plus one electronic copy and as requested by Consultant.

.15 Delete information not applicable to project.

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

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

1.5 SAMPLES

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

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

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

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

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

.6 Make changes in samples which Consultant may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.6 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

END OF SECTION

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1 General

1.1 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).
.3 Province of Prince Edward Island
  .1 Occupational Health and Safety Act, R.S.P.E.I. 1988.
.4 CSA C22.1-2021 - Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
.5 CSA C22.3 No. 1-M87 (R2001) - Overhead Systems.
.6 CSA C22.3 No. 7-94 (R2000) - Underground Systems.
.7 CSA - S269.1 - 1975 Falsework for Construction Purposes.
.8 CAN/CSA - S269.2 - M87 Access Scaffolding for Construction Purposes.
.9 COSH, Canada Occupational Health and Safety Regulations made under Part II of the Canada Labour Code.
.10 Fire Protection Standards issued by Fire Protection Services of Human Resources Development Canada as follows:
  .1 FCC No. 301 - June 1982 Standard for Construction Operations.
  .2 FCC No. 302 - June 1982 Standard for Welding and Cutting.
  .3 FCC standards, may be viewed at the Regional Fire Protection Services' office (previously known as the Fire Commissioner of Canada) located at 99 Wyse Road, 8th Floor, Dartmouth, NS, Tel: (902) 426-6053.

1.2 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
.2 Submit site-specific Health and Safety Plan: Within seven days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
  .1 Part 1: List of individual health risks and safety hazards identified by hazard assessments.
  .2 Part 2: List specific measures to control or mitigate each hazard and risk identified in part one of Plan. State engineering controls, personal protective equipment and safe work practices to be used for work having identified hazard(s) or risk(s).
  .3 Part 3: Emergency and Communications Measures as follows:
    .1 Emergency Procedures: standard operating procedures, evacuation measures and emergency response implemented on site during an accident or incident. State step by step procedures, applicable to each identified hazard.
    .2 Emergency Communications: list names and telephone numbers of officials, to be contacted if incident, accident or emergency situation occurs, including:
      .1 General Contractor and all Subcontractors.
      .2 Provincial Departments and resources from local emergency organizations, based on type of hazard, incident or accident which might occur and as stipulated in applicable laws and regulations.
.3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Consultant.
.4 Submit copies of incident and accident reports.
.5 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.
.6 Consultant will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five days after receipt of plan. Revise plan as appropriate and resubmit plan to Consultant within two days after receipt of comments from Consultant.

.7 Consultant's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
.8 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.
.9 Maintain Worker's Compensation Coverage for duration of contract. Submit Letter of Good Standing to Consultant.

1.3 DEFINITIONS

.1 Electrical Facility: means any system, equipment, device, apparatus, wiring, conductor, assembly or part thereof that is used for the generation, transformation, transmission, distribution, storage, control, measurement or utilization of electrical energy, and that has an amperage and voltage that is dangerous to persons.
.2 Guarantee of Isolation: means a guarantee by a competent person in control or in charge that a particular facility or equipment is isolated.
.3 De-energize: in the electrical sense, that a piece of equipment is isolated and grounded, e.g. if the equipment is not grounded, it cannot be considered de-energized (DEAD).
.4 Guarded: means that an equipment or facility is covered, shielded, fenced, enclosed, inaccessible by location, or otherwise protected in a manner that, to the extent that is reasonably practicable, will prevent or reduce danger to any person who might touch or go near such item.
.5 Isolate: means that an electrical facility, mechanical equipment or machinery is separated or disconnected from every source of electrical, mechanical, hydraulic, pneumatic or other kind of energy that is capable of making it dangerous.
.6 Live/alive: means that an electrical facility produces, contains, stores or is electrically connected to a source of alternating or direct current of an amperage and voltage that is dangerous or contains any hydraulic, pneumatic or other kind of energy that is capable of making the facility dangerous to persons.

1.4 PERMITS

.1 Obtain permits, licenses and compliance certificates, at appropriate times and frequency as stipulated by authorities having jurisdiction.
.2 Post all permits on site. Submit copies to Consultant.

1.5 FILING OF NOTICE

.1 File Notice of Project and other Notices with Provincial authorities prior to commencement of Work.

1.6 POSTING OF DOCUMENTS

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

1.7 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.
.2 Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.
.3 Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.8 MEETINGS

.1 Preconstruction Conference:

.1 The safety officer shall attend and chair the preconstruction conference and prepare a comprehensive agenda for the conference.

.2 Meeting On Work Procedures:
.1 Meet with Contracting Officer to discuss work procedures and safety precautions. Ensure the participation of the Contractor's superintendent, the quality control, officer and representatives of each subcontractor or trade performing work at the site.

.3 Weekly Safety Meetings:
.1 Hold weekly at the project site. Prepare minutes showing contract title, signatures of attendees, a list of topics discussed and meeting minutes.

.4 Work Phase Meetings:
.1 The appropriate activity hazard analysis shall be reviewed and attendance documented by the Contractor at the preparatory, initial, and follow-up phases of quality control inspection.

.5 Prior to commencement of work hold Health and Safety meeting. Have Contractor's Site Superintendent in attendance.

.6 Provide site safety orientation session to all workers, all workers new to the site and other authorized persons prior to granting them access to work site. Brief persons on site conditions and on the minimum site safety rules in force at site. Maintain records of orientation on site.

.7 Conduct site specific occupational health and safety meetings for the duration of the work as follows:
.1 Formal meetings on a minimum monthly basis.
.2 Informal tool box meetings on a regular basis from a predetermined schedule.

.8 Keep workers informed of anticipated hazards, on safety practices and procedures to be followed and of other pertinent safety information related to:
.1 Progress of Work;
.2 New sub-trades arriving on site and;
.3 Changes in site and project conditions.

.9 Record and post minutes of meetings. Make copies available to Consultant upon request.

1.9 SITE SAFETY OFFICER (SSO)

.1 Employ and assign to Work, competent and authorized representative as Site Safety Officer (SSO). The SSO must:
.1 Have minimum 2 years site-related working experience specific to activities associated with Construction.
.2 Have working knowledge of occupational safety and health regulations.
.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.2 The selection of the SSO will be subject to the approval of the Consultant, and changes shall be made as requested by the Consultant.

.3 The SSO shall be responsible for ensuring that all provisions of the Health and Safety Plan and relevant legislation are implemented.

.4 The SSO shall ensure that all monitoring and testing, as specified and at the direction of the Consultant, are conducted.

.5 The SSO shall maintain records of all readings that are taken by the Contractor report and any abnormal or dangerous situation to the Consultant and the Municipality, after having implemented emergency measures, as required, work shall not continue or proceed until the situation has been rectified.

.6 The Safety Officer shall be at the work site at all times whenever work or testing is being performed, shall conduct daily safety inspections.

.7 The SSO shall be authorized to act on behalf of the Contractor on all matters related to Health and Safety.

.8 Qualifications of Site Safety Officer:
- .1 Ability to manage the on-site Contractor safety program through appropriate management controls.
- .2 Ability to identify hazards and have the capability to expend resources necessary to abate the hazards.
- .3 Must have worked on similar types of projects that are equal to or exceed the scope of the project assigned with the same responsibilities.
- .4 Shall, as a minimum, have attended a recognized training qualification program including at least 40 hours of classroom instruction.

.9 Qualifications of Qualified Person, Confined Space Entry:
- .1 The qualified person shall be capable (by educations and specialized training) of anticipating, recognizing, and evaluating employee exposure to hazardous substances or other unsafe conditions in a confined space. This person shall be capable of specifying necessary control and protective action to ensure worker safety.

1.10 RECORD KEEPING

.1 ALL activities associated with Health and Safety shall be recorded daily in a bound notebook. Include as a minimum: activity date, time, location of occurrence, mitigation action taken and results. Records shall be assessed by the Consultant.

1.11 SUSPENSION OF ACTIVITIES

.1 Exposure to contaminants shall be controlled so that no worker is exposed to contaminants at a concentration greater than the Time Weighted Average (TWA) concentration for the contaminant, for up to a 10 hour workday, 40 hour work week.

.2 The Contractor will halt activities immediately during unsafe conditions. All costs relating to suspension of work for Contractor's failure to maintain Health and Safety procedures shall be borne by the Contractor.

.3 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

1.12 HEALTH AND SAFETY PLAN

.1 Prior to commencement of the work, submit to the Consultant a detailed Health and Safety Plan for review. The Health and Safety Plan shall comply with the provisions of this section, and shall illustrate the Contractor's knowledge and understanding of health and safety aspects of the work, the Contractor's intention to maintain a high level of safety on-site, and shall include, but not be limited to:
- .1 Description of Work.
- .2 Description of Site-specific Hazards:
  - .1 Physical
  - .2 Chemical
  - .3 Environmental
- .3 Protective Equipment:
  - .1 Respiratory
  - .2 Contact
- .4 Decontamination Procedures:
  - .1 Personal protective equipment (PPE)
  - .2 Equipment
- .5 Medical - Monitoring:
  - .1 Workers medical profile and suitability to work at the site.
- .6 Air - Monitoring Procedures:
  - .1 Action levels
  - .2 Site monitoring
  - .3 Perimeter monitoring
- .7 Emergency Procedures:

.1 Emergency Equipment
.2 Contingency Plans:
.1 Spill control
.2 Fire
.3 Ventilation
.4 Medical Emergency

.8 General Safety:
.1 Designation of site-safety officer
.1 Safety log
.2 Trenching, digging, excavations
.3 Storage of flammables, compressed gases
.4 Safety inspections

.9 Site Training:
.1 Initial hazard
.2 Daily safety

.2 All workers shall be trained and be familiar with the Health and Safety Plan and the use of personal protective equipment.

.3 Safety Document Submission:
.1 Ensure Safety Document Submission applies to Work of this specific project and site.
.2 Submit two copies of Safety Document at the Pre-Construction Meeting. Do not commence Work nor deliver material on-site prior to submission.
.3 Included in Safety Document submission specific information detailing the methods and procedures to be implemented ensuring adherence to the acts, regulations, codes and policies specified in this section and to:
.1 Ensure the health and safety of persons at or near the Work; including, but not limited to, the Public.
.2 Ensure the measures and procedures of the regulatory agencies specified are carried out.
.3 Ensure every employee, self-employed person and employer performing Work under this contract complies with the regulatory agencies specified.
.4 Where changes to the methods and procedures in the execution of work change submitted safety methods and procedures, modify submitted Safety Documentation and submit modifications, in writing to the Consultant and Minister prior to implementation.
.4 Safety Document Organization:
.1 Organize information in the form of an instructional manual as follows:
.1 Place in binders of commercial quality, 8-1/2" x 11" x 3" maximum ring size.
.2 Cover: Identify binder with typed or printed title "Project Safety Document" and list the title of the project.
.3 Provide tabbed fly leaf for each separate heading, with typed heading on tab.
.4 Where drawings are within the safety document, provide with reinforced punched binder tab. Bind in with text; fold in larger drawings to size text pages.
.5 Arrange content under Safety Document headings specified herein.
.5 Safety Document Headings:
.1 Employee Safety Training:
.1 Place, under this heading, a statement indicating employees working on this specific project have met specified training requirements.
.2 Company Safety Policy
.1 Place, under this heading, information pertaining to the company's policy and commitment to Occupational Health and Safety, including the responsibilities of management, supervisors and works.

1.13 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

.2 Perform on-going hazard assessments during the progress of Work identifying new or potential health risks and safety hazards not previously known. As a minimum hazard assessments shall be carried out when:

.1 New subtrade work, new subcontractor(s) or new workers arrive at the site to commence another portion of work.

.2 The scope of work has been changed by Change Order.

.3 Potential hazard or weakness in current health and safety practices are identified by Consultant or by an authorized safety representative.

.3 Each hazard assessment to be made in writing. Keep copies of all assessments on site for duration of Work. Upon request, make available to Consultant for inspection.

.4 Contractor to conduct a hazard assessment in conjunction with the Owner's maintenance staff as part of the planning process including isolating existing equipment where applicable and identification of hidden services where anchoring is required. Hazard Assessments to conform with requirements of Health and Safety Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.14 COMPLIANCE REQUIREMENTS

.1 Observe and enforce construction safety measures required by National Building Code, latest edition, National Fire Code, Provincial Building Code Act, Worker's Compensation Act and Municipal Statutes and Authorities.

.2 Comply with Canada Labour Code and Canada Occupational Health and Safety Act.

.3 Latest edition of the Occupational Health & Safety Act Statutes of Prince Edward Island (including any amendments to and regulations).

.4 Fire Prevention Act.

.5 Dangerous Goods Transportation Act.

.6 Industrial Best Practices for Equipment Isolation and Lockout Policy.

.7 In case of conflict or discrepancy the more stringent requirement shall apply.

.8 Maintain clear emergency exit paths.

.9 Ensure that employees working on this specific project have met training requirements as legislated by the Prince Edward Island Occupational Health and Safety Act and its regulations.

.10 Where reference is made to jurisdictional authorities, it shall mean all authorities who have within their constituted powers the right to enforce the laws of the place of the building and workplace.

.11 Provide Consultant with Material Safety Data Sheets (MSDS).

.12 Provide and maintain first aid equipment, supplied and medications appropriate to the work and its location in accordance with the First Aid Regulations. Obtain and implement recommendations from Occupational Health and Safety Division specific to the project work site.

1.15 WHMIS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of material safety data sheets acceptable to Labour Canada and Health and Welfare Canada and Provincial Department of Labour.

.2 Submit WHMIS data sheets to Consultant in accordance with Section 01 33 00 - Submittal Procedures.

.3 Maintain WHMIS information station and ensure designated personnel are trained in its use.

.4 Submit copies of all Tool Box or Safety Meeting notes.

.5 Submit copies of all Worksite Safety Inspections.

1.16 SMOKING, ALCOHOL & RESTRICTED SUBSTANCES

.1 Worksites are inherently dangerous, including travelling to and from the site.

.2 Alcohol, medical and recreational cannabis are restricted substances governed by Federal and Provincial laws as are other forms of illegal drugs.

.3 The smoking of or use of tobacco products, including e-cigarettes, the use of alcohol and restricted substances including cannabis in any form in the building or on the work site is strictly prohibited.

.4 Where workers have a prescription for medical cannabis, or other prescription drugs that may cause drowsiness, they are to advise their supervisor and discuss with their supervisor safe and appropriate task(s) while under the influence of these prescriptions on the worksite.

.5 Workers who violate this requirement will be removed from the worksite.

1.17 SITE CONTROL AND ACCESS

.1 Control work site and entry points. Grant and allow entry to only workers and other persons so authorized. Immediately stop non-authorized persons from circulating within construction areas and remove from site.

.2 Prior to gaining access to the site, all contractors, subcontractors and suppliers shall file with the General Contractor their proof of Workers Compensation coverage, proof of required Insurance and proof of contract. Upon request, proof of these documents will be provided to the Owner and Consultant.

.3 Delineate and isolate construction areas from other areas of site by use of appropriate means. Erect barricades, fences, hoarding and temporary lighting as required. See Section 01 50 00 - Facilities and Controls for minimum type of barriers acceptable.

.4 Erect signage at entry points and at other strategic locations around site, clearly identifying construction area(s) as being "off limits" to non-authorized persons. Signage must be professionally made.

1.18 PROTECTION

.1 Provide temporary facilities for protection and safe passage of building occupants, public pedestrian and vehicular traffic around and adjacent to work site.

.2 Provide safety barricades, lights and signage on work site as required to provide a safe working environment for workers.

.3 Use personal protection equipment as required by Occupational Health and Safety Act and as required by this site.

.4 Training of workers in the proper use, fitting, inspection and storage of personal protective equipment shall be done prior to use of the equipment.

1.19 UNFORESEEN HAZARDS

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

1.20 TESTING AND MONITORING

.1 Test and monitor for hazardous conditions, as required to demonstrate compliance with provincial regulations.

.2 If multiple locations are being worked simultaneously, provide monitoring at all locations where work is being carried out, including providing additional monitoring instruments.

1.21 ISOLATION OF EXISTING SERVICES

.1 Obtain Consultant's written authorization prior to conducting work on an existing active, energized service or facility required as part of the work and before proceeding with lockout of such services or facility.

.2 To obtain authorization, submit to Consultant following documentation:
- .1 Written Request two weeks in advance of work for Isolation of the service or facility and;
- .2 Copy of Contractor's Lockout Procedures.
- .3 Make a Request for Isolation for each event, unless directed otherwise by Consultant, and as follows:
  - .1 Fill-out standard forms in current use at the Facility when so directed by Consultant or;
  - .2 Where no form exist at Facility, make request in writing identifying:
    - .1 Identification of system or equipment to be isolated, including it's location;
    - .2 Time duration, indicating Start time & date and Completion time & date when isolation will be in effect.
    - .3 Voltage of service feed to system or equipment being isolated.
    - .4 Name of person making the request.
  - .3 Document to be in typewritten format.
- .4 Do not proceed until receipt of written notification from Consultant granting the Isolation Request and authorization to proceed with the isolation of designated equipment or facility. Consultant may designate other individual at the Facility as the person authorized to grant the Isolation Request.
- .5 Conduct safe, orderly shut down of equipment or facilities, de-energize and isolate power and other sources of energy and lockout items in accordance with requirement of clause 1.8 below.
- .6 Plan and schedule shut down of existing services in consultation with the Consultant and the Facility Manager. Minimize impact and downtime of facility operations.
- .7 Determine in advance, as much as possible, in cooperation with the Consultant, the type and frequency of situations which will require a Request for Isolation. Follow Consultant's directives in this regard.
- .8 Conduct hazard assessment as part of the planning process of isolating existing equipment and facilities. Hazard Assessments to conform with requirements of Health and Safety Section 01 35 29 - Health, Safety and Emergency Response Procedures.

1.22 LOCKOUTS

.1 Perform lockouts in compliance with:
- .1 Canadian Electrical Code
- .2 Federal and Provincial Occupational Health and Safety Acts and Regulations as specified in Section 01 35 29 - Health, Safety, and Emergency Response Procedures.
- .3 Regulations and code of practice as applicable to mechanical equipment or other machinery being de-energized.
- .4 Procedures specified herein.

.2 Isolate and lockout electrical facilities, mechanical equipment and machinery from all potential energy sources prior to starting work on such items.

.3 Develop and implement lockout procedures to be followed on site as an integral part of the Work.

.4 Use energy isolation lockout devices specifically designed and appropriate for type of facility or equipment being locked out.

.5 Use industry standard lockout tags.

.6 Provide appropriate safety grounding and guards as required.

.7 Prepare Lockout Procedures in writing. Describe safe work practices, work functions and sequence of activities to be followed on site to safely isolate all potential energy sources and lockout/tagout facilities and equipment.

.8 Include within procedures a system of worker request and issuance of individual lockout permit by a person, employed by Contractor, designated to be "in-charge" and being responsible for:
  .1 Controlling issuance of permits or tags to workers.
  .2 Determining permit duration.
  .3 Maintaining record of permits and tags issued.
  .4 Submitting a Request for Isolation to Consultant when required by Contractors and / or Owners safety plan.
  .5 Designating a Safety Watcher, when one is required based on type of work.
  .6 Ensuring equipment or facility has been properly isolated, providing a Guarantee of Isolation to worker(s) prior to proceeding with work.
  .7 Collecting and safekeeping lockout tags, returned by workers, as a record of the event.

.9 Clearly establish, describe and allocate, within procedures, the responsibilities of:
  .1 Workers.
  .2 Designated person controlling issuance of lockout tags/permits.
  .3 Safety Watcher.
  .4 Subcontractors and General Contractor.

.10 Procedures shall meet the requirements of Provincial and Federal Codes and Regulations.

.11 Generic procedures, if used, must be edited, supplemented with pertinent information and tailored to reflect specific project conditions. Clearly label as being the procedures applicable to this contract.
  .1 Incorporate site specific rules and procedures established by Facility Manager and in force at site. Obtain such procedures through Consultant.

.12 Procedures to be in typewritten format.

.13 Submit copy of Lockout Procedures to Consultant, in accordance with submittal requirements, prior to commencement of work.

1.23 CONFORMANCE

.1 Ensure that lockout procedures, as established for project on site, are stringently followed. Enforce use and compliance by all workers.

.2 Brief all persons working on electrical facilities, mechanical and other equipment fed by an energy source on requirements of this section.

.3 Failure to perform lockouts in accordance with regulatory requirements or follow procedures specified herein may result in the issuance of a Non-Compliance Notification at Consultant's discretion with possible disciplinary measures imposed as specified in Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.24 FIRE SAFETY REQUIREMENTS

.1 Comply with requirements of latest standard for Building Construction Operations issued by the Fire Commissioner of Canada and Fire Safety Regulations of Local Authority.

.2 Enforce fire protection methods, good housekeeping and adherence to local and underwriter's fire regulations including, but not limited to, Fire Protection Act and the Provincial Building Code Act. Provide UL approved fire extinguishers, and other fire fighting services and equipment, except where more explicit requirements are specified as the responsibility of individual Sections.

.3 Implement and follow fire safety measures during Work. Comply with following:
  .1 National Fire Code, 2020.
  .2 Fire Protection Standards FCC 301 and FCC 302.
  .3 Federal and Provincial Occupational Health and Safety Acts and Regulations as specified in Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

.4 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Consultant will advise on the course of action.

.5 Advise the Fire Chief in the area of Work of any work that would impede fire apparatus response, including but not limited to violation of minimum overhead clearance prescribed by the fire chief, erecting of barricades and digging of trenches.

.6 Fire Separations:

.1 Ensure that fire separations are installed to maintain total integrity and that they are not breached by Work following their installation.

.2 Replace fire separations which have suffered a lessening of their required rating during construction.

.7 Ensure nothing subverts the integrity of fire protection provided for the building structure.

.8 Coordinate work of all sections so that they do not encroach on space required for fire protection and its installation. Ensure that fire protection damage during construction is totally replaced.

1.25 FIRE PROTECTION AND ALARM SYSTEMS

.1 Fire protection and alarm systems shall not be:

.1 Obstructed.

.2 Shut-off, unless approved by Consultant.

.3 Left inactive at the end of a working day or shift.

.2 Do not use fire hydrants, standpipes and hose systems for purposes other than fire fighting.

.3 Costs incurred, from the fire department, Facility owner and tenants, resulting from negligently setting off false alarms will be charged to the Contractor in the form of financial progress payment reductions and holdback assessments against the Contract.

1.26 FIRE SAFETY

.1 The Sub-Contractors are to participate on the Fire Safety Committee under the Joint Health and Safety Committee. The Fire Safety Committee under the direction of the Contractor is responsible for implementation and maintenance of the Construction Fire Safety Plan.

.2 Construction Fire Safety Plan:

.1 The Construction Fire Safety Plan will include the following:

.1 Introduction of plan and purpose

.2 Fire Safety Committee

.3 Terms of reference.

.2 Committee composition.

.3 Emergency Procedures.

.4 Fire protection equipment.

.5 Building description.

.6 Provisions for fire fighting.

.7 Portable extinguishers.

.8 Exits.

.9 Emergency Lighting.

.10 Reduced drawings.

.11 Fire safety maintenance schedule:

.1 General.

.2 Maintenance levels.

.3 Skill categories.

.4 Frequency.

.5 Checklists.

.12 Other information:

.1 Instruction on use of fire extinguishers.

.2 Emergency Fire Drill procedures.

.3 Portable Fire Extinguishers:

.1 During construction, Contractor is to provide and maintain on the site at all times, ULC listed 25 lb ABC dry chemical type portable fire extinguishers.

.4 Blockage of Roadways:
- .1 The Fire Department shall be advised of any work that would impede fire apparatus response. This includes violation of minimum overhead clearance, as prescribed by the Fire Department, erecting of barricades and the digging of trenches.

.5 Rubbish and Waste Materials:
- .1 Rubbish and waste materials are to be kept to a minimum.
- .2 The burning of rubbish is prohibited.
- .3 Removal:
  - .1 All rubbish shall be removed from the work site at the end of the workday or shift or as directed by Consultant.
- .4 Storage:
  - .1 Extreme care is required where it is necessary to store oily waste in work areas to ensure maximum possible cleanliness and safety.
  - .2 Greasy or oily rags or materials subject to spontaneous ignition shall be deposited and kept in an approved receptacle and removed as required in 1.7.3.1.

.6 Flammable Liquids:
- .1 The handling, storage and use of flammable liquids are to be governed by the current National Fire Code of Canada.
- .2 Flammable liquids such as gasoline, kerosene and naphtha may be kept for ready use in quantities not exceeding 45 liters provided they are stored in approved safety cans bearing the Underwriter's Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable liquids exceeding 45 liters for work purposes, requires the permission of the Fire Department.
- .3 Transfer of flammable liquids having a flash point below 38ºC is prohibited within buildings.
- .4 Transfer of flammable liquids shall not be carried out in the vicinity of open flames or any type of heat-producing devices.
- .5 Flammable liquids having a flash point below 38ºC, such as naphtha or gasoline, shall not be used as solvents or cleaning agents.
- .6 Flammable waste liquids, for disposal, shall be stored in approved containers located in a safe ventilated area. Quantities are to be kept to minimum and the Fire Department is to be notified when disposal is required.

.7 Fire Inspection:
- .1 The Fire Department shall be allowed unrestricted access to the work site.
- .2 The Contractor shall cooperate with the Fire Department during routine inspections of the work site.
- .3 The Contractor shall immediately remedy all unsafe fire situations observed by the Fire Department.

.8 Reporting Fires:
- .1 Know the location of the nearest fire alarm box and telephone, including the emergency phone number.
- .2 Report immediately all fire incidents to the fire department as follows:
  - .1 Activate nearest fire alarm box, or
  - .2 Telephone 911.
  - .3 Where fire alarm box is exterior to building, the person activating the fire alarm box shall remain at the box to direct Fire Department to scene of the fire.
  - .4 When reporting a fire by telephone, give location of fire, name or number of building and be prepared to verify the location.

1.27 WELDING AND CUTTING

.1 Use noncombustible shields for electric and gas welding or cutting executed within two meters of combustible material or in occupied space.

.2 Place tanks supplying gases as close to work as possible. Fix in upright position, free from exposure to sun or high temperatures.

.3 Locate fire extinguishing equipment near all welding and cutting operations.

1.28 OPEN FLAMES, SPARKS, EXPLOSION PROTECTION

.1 Keep open flames and sparks to minimum. When flame or sparks are required, follow proper procedures to prevent fire or explosion.

1.29 HOT WORK AUTHORIZATION

.1 Hot Work will not be permitted on or within the building structure, tanks, or confined spaces, except as outlined herein.

.2 Obtain Consultant's written "Authorization to Proceed" before conducting any form of Hot work on site.

.3 To obtain authorization submit to Consultant:

- .1 Contractor's typewritten Hot Work Procedures to be followed on site as specified below.
- .2 Description of the type and frequency of Hot Work required.
- .3 Sample Hot Work Permit to be used. Shall be included in the safety documentation submission.

.4 Upon review and confirmation that effective fire safety measures will be implemented during performance of hot work, Consultant will provide authorization to proceed as follows:

- .1 Issue one written "Authorization to Proceed" covering the entire project for duration of work or;
- .2 Separate work, or segregate certain parts of work, into individual entities. Each entity requiring a separately written "Authorization to Proceed" from Consultant. Follow Consultant's directives in this regard.

.5 Requirement for individual authorization based on:

- .1 Nature or phasing of work;
- .2 Risk to Facility operations;
- .3 Quantity of various trades needing to perform hot work on project or;
- .4 Other situation deemed necessary by Consultant to ensure fire safety on premises.

.6 Do not perform any Hot Work until receipt of Consultant's written "Authorization to Proceed" for that portion of work.

.7 In tenant occupied Facility, coordinate performance of Hot Work with Facility Manager through the Consultant. When directed, perform Hot Work only during non-operative hours of Facility. Follow Consultant's directives in this regard.

1.30 HOT WORK PROCEDURES

.1 Develop and implement safety procedures and work practices to be followed during the performance of Hot Work.

.2 Procedures to include:

- .1 Requirement to perform hazard assessment of site and immediate hot work area for each hot work event in accordance with Hazard Assessment and Safety Plan requirements of Section 01 35 29 - Health, Safety, and Emergency Response Procedures.
- .2 Use of a Hot Work Permit system for each hot work event.
- .3 The step by step process of how to prepare and issue permit.
- .4 Permit shall be issued by Contractor's site Superintendent, or other authorized person designated by Contractor, granting permission to worker or subcontractor to proceed with hot work.

.5 Maintain a fire extinguisher in the immediate area where hot work is being undertaken.
.6 Provision of a designated person to carryout a Fire Safety Watch for a minimum of 2 hours immediately upon completion of the hot work.
.7 Compliance with fire safety codes and standards specified herein and Occupational Health and Safety regulations specified in Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

.3 Generic procedures, if used, must be edited and supplemented with pertinent information tailored to reflect specific project conditions. Clearly label as being the Hot Work Procedures applicable to this contract.

.4 Hot Work Procedures shall clearly establish worker instructions and allocate responsibilities of:
.1 Worker(s),
.2 Authorized person issuing the Hot Work Permit,
.3 Fire Safety Watcher,
.4 Subcontractors and Contractor.

.5 Brief all workers and Subcontractors on Hot Work Procedures and Permit system established for project. Stringently enforce compliance.
.1 Failure to comply with the established procedures may result in the issuance of a Non-Compliance Notification at Consultant's discretion with possible disciplinary measures imposed as specified in Section 01 35 29 - Health, Safety, and Emergency Response Procedures.

1.31 HOT WORK PERMIT

.1 Hot Work Permit to include, as a minimum, the following data:
.1 Project name and project number;
.2 Building name, address and specific room or area where hot work will be performed;
.3 Date when permit issued
.4 Description of hot work type to be performed;
.5 Special precautions required, including type of fire extinguisher needed;
.6 Name and signature of person authorized to issue the permit.
.7 Name of worker (clearly printed) to which the permit is being issued.
.8 Time Duration that permit is valid (not to exceed 8 hours). Indicate start time & date and completion time & date.
.9 Worker signature with date and time upon hot work termination.
.10 Specified time period requiring safety watch.
.11 Name and signature of designated Fire Safety Watcher, complete with time & date when safety watch terminated, certifying that surrounding area was under his continual surveillance and inspection during the full watch time period specified in Permit and commenced immediately upon completion of Hot Work.

.2 Permit to be typewritten form. Industry Standard forms shall only be used if all data specified above is included on form.

.3 Each Hot Work Permit to be completed in full and signed as follows:
.1 Authorized person issuing Permit before hot work commences;
.2 Worker upon completion of Hot Work;
.3 Fire Safety Watcher upon termination of safety watch;
.4 Returned to Contractor's Site Superintendent for safe keeping.
.5 The permit shall describe compliance with the following procedures. After tank or confined space interiors or building areas have been decontaminated, hot work may be conducted only when the tank or confined space is inverted. Hot work shall not be performed unless monitoring indicates atmospheres within and immediately surrounding are less than eight percent (8%) oxygen inside less than ten percent (10%) of the LFL outside; continuous monitoring shall continue until the hot work is completed. The hot work prohibition includes welding, cutting, grinding, sawing, or

other similar operations which could be expected to potentially generate combustion-producing temperatures or sparks, or which could produce potentially hazardous fumes or vapours. An individual at each hot work site shall be designated as a fire watch. This person's sole responsibility shall be to monitor the hot work and have immediate access to at least two (2) twenty (20) pound fire extinguishers located at each hot work site. All extinguishers shall be currently inspection tagged, approved safety pin and tamper resistant seal. A new permit shall be obtained at the start of each work shift during which hot work will be conducted.

1.32 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Consultant.

1.33 POWER ACTUATED DEVICES

.1 Use power actuated devices only after receipt of written permission from Consultant.

1.34 HANDLING AND TRANSPORTATION OF DANGEROUS GOODS

.1 Observe and enforce all measures required by the regulatory agencies including but not limited to Environment Canada, Prince Edward Island Department of Environment, and Transport Canada.
.2 Most current regulatory guidelines and Acts will apply to the work.
.3 In case of any conflict, the more stringent requirements will apply.

1.35 OPEN EXCAVATIONS

.1 If open foundations or demolition areas are to be left at the end of a work day, protective fencing must be placed around the entire perimeter to limit access by others. Fencing to be self-supporting, approved by the Department of Labour and the Construction Safety and Industrial Safety Regulations.

1.36 POTENTIAL HAZARDS

.1 Hazards include, but are not limited to, toxic, flammable and explosion hazards associated with cleaning solvents.
.2 The Contractor shall become familiar with all potential hazards associated with the work, and shall take necessary measures to avoid injury or damage of any kind.

1.37 HAZARDOUS MATERIALS

.1 Should material resembling hazardous materials, other than those identified with the Contract Documents, including but not limited to spray or trowel applied asbestos, be encountered in course of work; stop work immediately. Do not proceed until written instructions have been received from Consultant.
.2 Any material which contains asbestos that is disturbed or removed during construction work, shall be removed in accordance with the regulations set out by the Occupational Health and Safety Act. All costs for proper cutting, removal and disposal of all asbestos identified in this contract shall be included in Tender.
.3 Where work entails use, storage, or disposal of toxic or hazardous materials, chemicals and/or explosives, or otherwise creates a hazard to life, safety, health, or the environment; work shall be in accordance with the Authority Having Jurisdiction (AHJ).

1.38 ENVIRONMENTAL PROTECTION

.1 Ensure that pollution and environmental control of construction activities are exercised during the Work to requirements of the federal and provincial environmental acts; including, but not limited to, the Prince Edward Island Environmental Protection Act.

1.39 SANITATION / DECONTAMINATION PRACTICES

.1 After each use, all disposable protective equipment shall be collected in a dedicated container for disposal.
.2 All respiratory equipment shall be decontaminated daily after use.
.3 All tools, pumps and equipment used during cleanup should be dedicated to the handling of contaminants and labeled as such and thoroughly decontaminated at the completion of the project.
.4 Contaminated work clothing shall not be worn outside of regulated areas.
.5 Workers shall wash their hands and exposed skin before eating, drinking, smoking or using toilet facilities during work shift, and at the completion of a work shift.
.6 Food, drink and tobacco products shall not be permitted in regulated areas.

1.40 WORK PRACTICES AND ENGINEERING CONTROLS

.1 Access to work areas shall be regulated and limited to authorized persons. A daily roster shall be kept of persons entering such areas.
.2 Handling Contaminants and General Work Practices.
  .1 Transportation and handling of contaminants to meet applicable local, provincial and federal regulations.
  .2 Emergency respiratory equipment shall be located in readily accessible locations which will remain minimally contaminated with contaminants in an emergency.
  .3 Containers and systems shall be handled and opened with care. Approved protective clothing shall be worn by all employees engaged in regulated areas.
  .4 All wastes and residues containing contaminants shall be collected in appropriate containers.
.3 Confined or Enclosed Spaces
  .1 Entry into confined or enclosed spaces, where there is limited egress, shall be controlled by a permit system. Permits shall be signed by an authorized representative of the employer and shall certify that appropriate measures have been taken to prevent adverse effects on the worker's health as a result of his or her entry into such space.
  .2 Confined or enclosed spaces which have contained contaminants shall be thoroughly ventilated to assure an adequate supply of oxygen, tested for contaminants, and inspected for compliance with these requirements prior to each entry. Adequate ventilation shall be maintained while workers are in such spaces. Each individual entering such confined or enclosed space shall be furnished with appropriate personal protective equipment and clothing and be connected by a lifeline harness to standby worker stations outside of the space. The standby worker shall also be equipped for entry with approved personal protective equipment and clothing and have contact with a third person. The standby person shall maintain communication (visual, voice, signal line, telephone, radio, or other suitable means) with the employee inside the confined or enclosed space.
  .3 Workers entering confined spaces and standby workers shall be trained at a recognized confined space training program.

1.41 PRE-CONSTRUCTION CONTRACTOR SAFETY CHECKLIST

.1 Use this text as a guideline for completing the following checklist. This checklist is a general, pre-construction review of the Contractor safety program, as well as an information session to identify what the Owner requires of the Contractor. Where the item requires a submission, ensure that it is received. If the item does not apply, enter N/A for not applicable.
.2 The following information will assist in establishing what will be reviewed in each section:
  .1 Safety Policy: Each employer is required by law (in Prince Edward Island) to have a safety policy and program and to implement that policy. The Owner will ask for a copy of that program.

.2 Safety Representative: Each Contractor is required to advise the Owner who their safety representative is. That representative has duties as described in the Occupational Health and Safety Act.

.3 Emergency Procedure: Each Contractor must have a site specific layout and emergency plan complete with emergency phone numbers.

.4 Employee Orientation: Each and every person working for a Contractor, including Sub-Contractors, will be given an orientation to familiarize them with the site safety program. Unless otherwise specified, each Sub-Contractor is responsible for the orientation of their workers.

.5 Safe Work Plan: Most Contractors are involved in tasks that subject workers to hazards. In order to ensure that these workers are secured from hazard, the Contractor will supply the Owner with a written safe work plan which affords protection against the hazards. This plan must be signed by a company representative and communicated to the workers involved in the task.

.6 Personal Protective Equipment Review: Advise that all workers require CSA Class "B" hard-hat, CSA "Green Patch" (eight inch) footwear, eye, ear and respiratory protection as required (boots and hats at all times).

.7 Fall Protection: Fall restraint or fall arrest protection required where a fall of 2.4 meters or more is possible. NO EXCEPTIONS.

.8 Housekeeping: Advise of daily, or as needed, clean-up requirements.

.9 Tool Box Talks: Each Contractor is required to conduct weekly safety meetings with their forces and advise the Owner they have been done.

.10 Material Handling / Storage: Advise Contractor about storage areas and handling of material so as not to endanger their worker or another worker. Stacked material to be banded, chained, blocked or otherwise secured.

.11 Landing Platform: Advise Contractor about movement of material on or off platforms. All material to be secured. Platform gates or chains to be kept closed at all times workers are on platform. If not possible, worker to be tied off with fall restraint system independent of platform.

.12 WHMIS Training: Receive verification that all workers are trained and that the Contractor submits their MSDS.

.13 GFCI: Advise Contractor that all tools are required to have ground fault circuit interrupters (where electricity is supplied by Contractor).

.14 Accident Investigations: Any injury to any of their workers must be investigated and reported to the Owner.

.15 Verbal, Written, Gone: Explain Zero Tolerance Program.

.16 Joint / Worker Safety Committee: Sites of over 20 workers must establish a safety committee; over 50 workers, an additional worker committee. Workers required to attend committee meetings will do so and not be prevented by employers.

.17 Fire Protection: All trades involved in performing hot work of any kind are required to provide fire protection at the work location.

.18 Guardrails: Advise Contractor that where temporary removal guardrails required, guardrails must be replaced as soon as possible.

.19 First Aider: Each Contractor is required to have a first aid kit and trained first aider. Employer must name their first aider.

.20 Visitors: Advise Contractor that any visitors to site must be suitably protected from hazard. They must wear hard hat, safety vest, and proper safety footwear while on site.

.21 Task Lighting: Review responsibilities of task specific lighting (who provides it).

.22 Swamper / Rigger Competency: Where cranes are used, the Contractor must use a swamper / rigger. They shall provide the Owner with a written statement identifying, by name(s) their rigger and that the named person is a competent work as described in the Construction regulation.

.23 Scaffolds: Review scaffold building requirement:

.1 Use all braces required by design.

.2 Access ladder for platform over 1.5 meters.
.3 Full width platform if height over 3 meters.
PEI Regulations require double planks.
.4 Tied in three time base dimension or use of outriggers.
.5 Engineered over 16 meters in height (standard frame type).

.24 Elevating Work Platforms:
.1 All boom and scissors lifts required to be CSA approved and have approval on machine.
.2 Operators manual required on machine at all times.
.3 Maintenance record on machine at all times.
.4 Operator must receive training in operation of equipment.
.5 Fall protection must be used at all times on a boom lift.
.6 Fall protection required to be used on scissors lift when unit is being moved.

.25 Protruding Rebar: Installers of reinforcing steel must protect the protruding hazard or make arrangements to have it protected. Removal of protective coverings for task purposes only is allowed, however, protective covering must be replaced as soon as possible.

.26 WCB Clearance Certificates: Advise Contractor that the Owner will not release any funds for payment until Workers Compensation Board Clearance Certificate has been received by the Owner.

.3 The following checklist is a general pre-construction review of the Contractor's safety program as required by the Owner.

PROJECT: _____ DATE: _____

CONTRACTOR: _____

WORK BEING PERFORMED: _____

Checkmark means YES / X means NO

.1 ____ Safety Policy Submitted
.2 ____ Safety Representative
.3 ____ Emergency Procedure Review
.4 ____ Employee Orientation
.5 ____ Written Safe Work Plan
.6 ____ Personal Protective Equipment Review
.1 ____ Hard Hat & Footwear
.2 ____ Safety Glasses & Hearing
.7 ____ Dust & Fumes
.8 ____ Fall Protection
.9 ____ Housekeeping
.10 ____ Tool Box Safety Talks (Weekly)
.11 ____ Material Handling / Storage
.12 ____ Landing Platforms
.13 ____ WHMIS Training Verification
.14 ____ GFCI Requirements
.15 ____ Accident / Incident Investigations Notification
.16 ____ Verbal, Written, Gone
.17 ____ Joint / Worker Safety Committee
.18 ____ Fire Protection
.19 ____ Guardrails
.20 ____ First Aider on Staff - Name Supplied
.21 ____ Visitors & Safety Equipment
.22 ____ Task Lighting

.23 ____ Swampers / Riggers Competency (in writing)
.24 ____ Scaffolds
.25 ____ Elevating Work Platforms
.26 ____ Protruding Rebar Protection - MSDS Received
.27 ____ WCB Clearance Certificate.

_____	_____
(Print name and title)	(Print name and title)
_____	_____
Owner Representatives (Signature)	Contractor Representatives (Signature)
_____(Date)	_____(Date)

END OF SECTION

1 General

1.1 FIRES

.1 Fires and burning of rubbish on site not permitted.

1.2 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.
.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.3 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.4 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties.
.2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
.3 Protect roots of designated trees to drip line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
.4 Minimize stripping of topsoil and vegetation.
.5 Restrict tree removal to areas indicated or designated by Consultant.

1.5 WORK ADJACENT TO WATERWAYS

.1 Do not operate construction equipment in waterways.
.2 Do not use waterway beds for borrow material.
.3 Do not dump excavated fill, waste material or debris in waterways.
.4 Design and construct temporary crossings to minimize erosion to waterways.

1.6 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.
.2 Control emissions from equipment and plant to local authorities emission requirements.
.3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.7 SMOKING RESTRICTIONS

.1 Smoking is not permitted inside the building at any time or at any stage of construction.

1.8 ENVIRONMENTAL PERMIT APPROVAL

.1 Comply with requirements contained in the Transportation and Public Works Environmental Management Division environmental approval permit for the project.

END OF SECTION

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1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) 2020 including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

.1 Asbestos: Demolition of spray or trowel-applied asbestos is hazardous to health. Should material resembling spray or trowel-applied asbestos be encountered in course of demolition work, immediately stop work and notify Consultant.

.2 Should material suspected of containing PCB's be encountered in the course of demolition work, immediately stop work and notify Consultant.

END OF SECTION

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1 General

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)
  .1 CCDC 2-2020, Stipulated Price Contract.

1.2 INSPECTION

.1 Allow Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Consultant instructions, or law of Place of Work.
.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
.4 Consultant may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Owner shall pay cost of examination and replacement.

1.3 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies are to be engaged by Owner for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Owner.
.2 Provide equipment required for executing inspection and testing by appointed agencies.
.3 Employment of Inspection/Testing Agencies does not relax responsibility to perform Work in accordance with Contract Documents.
.4 If defects are revealed during inspection and/or testing, appointed agency may request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Pay costs for retesting and re inspection.

1.4 PROCEDURES

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

1.5 REJECTED WORK

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

1.6 REPORTS

.1 Submit digital copies of inspection and test reports to Consultant.
.2 Provide digital copies to Subcontractor of work being inspected or tested.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be requested.
.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Consultant and may be authorized as recoverable.

1.8 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
.2 Construct in all locations acceptable to Consultant.
.3 Prepare mock-ups for Consultant's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
.5 If requested, Consultant will assist in preparing a schedule fixing dates for preparation.
.6 Remove mock-up at conclusion of Work or when acceptable to Consultant.
.7 Mock-ups may remain as part of Work as directed by Consultant.

1.9 MILL TESTS

.1 Submit mill test certificates as requested.

1.10 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

END OF SECTION

1 General

1.1 INSTALLATION AND REMOVAL

.1 Contractor to provide temporary utilities identified in this Section, in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.2 DEWATERING

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

.2 Filter water containing silt through geofabric prior to discharge into municipal storm water system or water course.

1.3 WATER SUPPLY

.1 Water supply in reasonable quantities is available on site and will be provided for construction usage at no cost. Make arrangements for the use and transportation of such services to work area through the Consultant.

1.4 TEMPORARY POWER

.1 Power is available on site and will be provided for construction usage at no cost for operating of power tools and lighting to a maximum supply of 208 Volts, three phase, 60 Amps.

.1 Request and make arrangements for the use of such services in writing through the Consultant.

.2 Consultant will designate and approve locations of existing (normal) power sources to which connections can be made to obtain temporary power service, and the feeder routing for this power supply.

.3 Connect temporary power supply for construction activities in accordance with Canadian Electrical Code (CSA 22.1-21).

.1 Perform work and make all connections in accordance with the CSA 22.1-21, and in compliance with the federal and provincial Occupational Health and Safety Regulations and to lockout requirements specified in Section 01 35 29 - Health, Safety and Emergency Response Procedures.

.4 Electrical power and lighting systems installed under this Contract can be used for construction requirements only with prior approval of Consultant and provided that facility operations are not affected. Make good damage circuits or services impacted by this work.

1.5 TEMPORARY LIGHT

.1 Provide and maintain temporary lighting throughout project. Ensure level of illumination is not less than 160 lx.

.2 Connect to existing power supply in accordance with CSA 22.1-21 and provide switching.

.3 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant and provided that facility operations are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.6 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel. The building electrical system cannot be used for temporary heat.

.2 Construction heaters used inside building must be vented to outside or be flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.
.3 Prevent moisture condensation on surfaces.
.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
.5 Maintain temperatures of 19-21 degrees C in areas where finish work is being performed.
.6 Ventilating:
.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
.4 Ventilate storage spaces containing hazardous or volatile materials.
.5 Ventilate temporary sanitary facilities.
.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
.7 Permanent heating system of building, may be used when available. Be responsible for damage to heating system if use is permitted. Use of permanent system will not affect warranty.
.8 On completion of Work for which permanent heating system is used, replace filters.
.9 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.
.10 Pay costs for maintaining temporary heat, when using permanent heating system.
.11 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
.1 Conform with applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.
.4 Prevent damage to finishes.
.12 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.7 FIRE PROTECTION

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

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Construction Documents Committee (CCDC)
  .1 CCDC 2-2020, Stipulated Price Contract.
.2 Fall Protection and Scaffolding Regulations, Province of Prince Edward Island.

1.2 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
.2 Identify areas which have to be graveled to prevent tracking of mud.
.3 Indicate use of supplemental or other staging area.
.4 Provide construction facilities in order to execute work expeditiously.
.5 Remove from site all such work after use.

1.3 OVERLOADING

.1 Ensure no part of work is subjected to a load that will endanger its safety or cause permanent deformation.

1.4 FALSEWORK

.1 Design and construct falsework in accordance with CSA s269.2.

1.5 SCAFFOLDING AND FALL ARREST

.1 Provide and maintain scaffolding.
.2 Design, construct and maintain scaffolding in rigid, secure and safe manner in accordance with CAN/CSA-S269.2.
.3 Erect scaffolding independent of walls. Remove when no longer required.
.4 Comply with the requirements of the Fall Protection and Scaffolding Regulations, Province of Prince Edward Island.
.5 Each user of scaffolding shall examine scaffolding for sufficiency before using it. Make scaffolding secure or notify Contractor.

1.6 HOISTING

.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
.2 Hoists and cranes shall be operated by qualified operator.
.3 Maintain current inspection certificate.
.4 Qualifications of crane operator must be submitted to Consultant for approval and must be authorized to operate the crane.

1.7 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.8 CONSTRUCTION PARKING

.1 Limited parking will be permitted on site, as assigned by Consultant. All non-conforming contract parking is subject to towing of the non-conforming vehicle's owner's expense.
.2 Provide and maintain adequate access to project site.
.3 Clean all areas where used by Contractors equipment.

.4 Parking for delivery and service vehicles for the supply and removal of construction materials and debris will be restricted to within the limit of contract and site fencing.

1.9 SECURITY

.1 Provide and pay for responsible security personnel as Contractor deems necessary to guard site and contents of site after working hours and during holidays.

1.10 OFFICES

.1 The construction area can be used as an office for the contractor and subcontractors. Provide table and chairs.
.2 Provide marked and fully stocked first-aid case in a readily available location.
.3 Maintain in clean condition.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.
.3 Provide adequate weather tight, heat and ventilation appropriate for the use and storage of equipment, tools and materials.
.4 Each user of equipment or tools shall be appropriately trained and be responsible to examine for sufficiency before use. Make equipment and tools safe if necessary, or notify the Contractor in writing that user will not commence work with such tools until it is made safe.

1.12 SANITARY FACILITIES

.1 The Contractor shall provide, maintain, service, and remove portable toilet facilities (Porta-Potties) for the duration of the Work. Locate facilities as approved by the Owner and maintain them in a clean, sanitary, and fully operational condition in accordance with applicable regulations. All costs associated with the provision, servicing, maintenance, and removal of the facilities shall be borne by the Contractor.
.2 New and existing permanent facilities may NOT be used.
.3 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.

1.13 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.
.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Consultant.
.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
.4 Protect traveling public from damage to person and property.
.5 Contractors traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
.7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
.8 Dust control: adequate to ensure safe operation at all times.
.9 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
.10 Provide snow removal during period of Work.

1.14 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.
.2 Clean dirt or mud tracked onto paved or surfaced roadways.
.3 Store materials resulting from demolition activities that are salvageable.
.4 Stack stored new or salvaged material not in construction facilities.

END OF SECTION

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1 General

1.1 REFERENCE STANDARDS

.1 Manual of Uniform Traffic Control Devices for Streets and Highways - 2009 Edition with 2012 Revisions.

.2 Prince Edward Island Transportation and Public Works

.1 Temporary Workplace Traffic Control Manual - 2016.

1.2 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.

.2 Review with City Public Works Manager all precautions to be taken and safety measures to be put in place and obtain acceptance before proceeding with work.

.3 When working on traveled way:

.1 Place equipment in position to present minimum of interference and hazard to traveling public.

.2 Keep equipment units as close together as working conditions permit and preferably on same side of traveled way.

.3 Do not leave equipment on traveled way overnight.

.4 Do not close any lanes of road without approval of City Public Works Manager. Before re-routing traffic erect suitable signs and devices in accordance with instructions contained in Part D of UTCD.

.5 Keep traveled way graded, free of pot holes and of sufficient width for required number of lanes of traffic.

.1 Provide minimum 7 m wide temporary roadway for traffic in two-way sections through Work and on detours.

.2 Provide minimum 5 m wide temporary roadway for traffic in one-way sections through Work and on detours.

.6 As indicated, provide graveled detours or temporary roads to facilitate passage of traffic around restricted construction area.

.7 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, unless other means of road access exist that meet approval of Consultant.

1.3 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Work which requires road user response.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in Part D, Temporary Conditions Signs and Devices, of UTCD manual.

.3 Place signs and other devices in locations recommended in UTCD manual.

.4 Meet with Consultant prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Consultant.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day to day.

1.4 CONTROL OF PUBLIC TRAFFIC

.1 Provide competent flag persons, trained in accordance with, and properly equipped as specified in, UTCD manual in the following situations:

.1 When public traffic is required to pass working vehicles or equipment that block all or part of traveled roadway.
.2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
.3 When workmen or equipment are employed on traveled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
.4 Where temporary protection is required while other traffic control devices are being erected or taken down.
.5 Provide full time flag person during daylight hours to control both construction activities and public traffic and to permit pedestrians safe passage.
.6 For emergency protection when other traffic control devices are not readily available.
.7 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
.8 Delays to public traffic due to contractor's operators: maximum 10 minutes.
.9 Flag person to have two-way radio communications at all times.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)
  .1 CGSB 1.189M-84, Primer, Alkyd, Wood, Exterior.
  .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
.2 Canadian Standards Association (CSA International)
  .1 CSA-O121-M1978, Douglas Fir Plywood.

1.2 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.
.2 Remove from site all such work after use.

1.3 DUST CONTROL BARRIERS - HOARDING

.1 Provide full dust control barriers, sealed at floor, walls and underside of floor deck / roof deck between renovation spaces and remaining areas of the building. Do not damage finishes that are to remain or that cannot be repaired.

1.4 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and other areas where a change in elevation of greater than 900mm exists.
.2 Provide as required by governing authorities.

1.5 ACCESS TO EXITS

.1 Maintain access to all existing exits at all times.

1.6 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
.3 Design enclosures to withstand wind pressure and snow loading.

1.7 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.8 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.9 FIRE ROUTES

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

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.
.2 Be responsible for damage incurred.

1.11 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
.2 Provide necessary screens, covers, and hoardings.
.3 Confirm with Consultant locations and installation schedule three days prior to installation.
.4 Be responsible for damage incurred due to lack of or improper protection.

1.12 PROTECTION OF LANDSCAPE ELEMENT

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
.2 Be responsible for damage incurred due to lack of or improper protection.

END OF SECTION

1 General

1.1 GENERAL

.1 Use new material and equipment unless otherwise specified.

.2 Within seven days of written request by Consultant, submit following information for materials and products proposed for supply:

- .1 Name and address of manufacturer.
- .2 Trade name, model and catalog number.
- .3 Performance, descriptive and test data.
- .4 Manufacturer's installation or application instructions.
- .5 Evidence of arrangements to procure.

.3 Use products of one manufacturer for equipment or material of same type or classification unless otherwise specified.

1.2 REFERENCE STANDARDS

.1 Conform to reference standards, in whole or in part as specifically requested in specifications.

.2 If there is question as to whether any product or system is in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.

.3 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.3 CONFORMANCE

.1 When material or equipment is specified by standard or performance specifications, upon request of Consultant, obtain from manufacturer an independent testing laboratory report, stating that material or equipment meets or exceeds specified requirements.

1.4 SUBSTITUTION OF MATERIAL

.1 Proposals for substitution may be submitted only after award of Contract. Such requests must include statements of respective costs of items originally specified and proposed substitutions.

.2 Proposals will be considered by Consultant if:

- .1 Products selected by tenderer from those specified, are not available, or
- .2 Delivery date of products selected from those specified would unduly delay completion of Contract.
- .3 Alternative products to those specified, which are brought to attention of, and considered by Consultant as equivalent to those specified and will result in credit to Contract amount.
- .4 Should proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on project. Pay for design or drawing changes required as a result of substitution.
- .5 Amounts of all credits arising from approval of substitutions will be determined by Consultant and Contract price will be reduced accordingly. No substitutions will be permitted without prior written approval of Consultant.

1.5 QUALITY OF PRODUCTS

.1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.

.4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.6 QUALITY OF WORK

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

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

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

1.7 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 Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

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

1.8 TRANSPORTATION

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

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

1.9 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

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

.8 Remove and replace damaged products at own expense and to satisfaction of Consultant.

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

1.10 MANUFACTURER'S INSTRUCTIONS

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

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

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

1.11 CO-ORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

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

1.12 FASTENINGS - GENERAL

.1 Provide metal fastenings and accessories in same texture, color and finish as base metal in which they occur.

.2 Prevent electrolytic action between dissimilar metals.

.3 Use non-corrosive fasteners, anchors and spacers for securing exterior work.

.4 Space anchors within limits of load bearing or shear capacity and ensure that they provide positive permanent anchorage. Wood plugs not acceptable.

.5 Keep exposed fastenings to minimum, space evenly and lay out neatly.

.6 Fastenings which cause spalling or cracking are not acceptable.

.7 Obtain Consultant's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166-1975, and observe restrictions in Section 01 35 29 - Health, Safety and Emergency Response Procedures.

1.13 FASTENINGS - EQUIPMENT

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

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

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

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

1.14 LOCATION OF FIXTURES

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

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

1.15 CONCEALMENT

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

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

1.16 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

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

1.17 CONSTRUCTION EQUIPMENT AND PLANT

.1 On request, prove to the satisfaction of Consultant that the construction equipment and plant are adequate to manufacture, transport, place and finish work to quality and production rates specified. If inadequate, replace or provide additional equipment or plant as directed.

.2 Maintain construction equipment and plant in good operating order.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Recording of subsurface conditions found.
.2 Survey services to determine measurement inverts for the Work.
.3 Requirements and limitations for cutting and patching the Work.

1.2 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practice in Prince Edward Island.

1.3 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings.
.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Consultant.

1.4 LOCATION OF EQUIPMENT AND FIXTURES

.1 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
.2 Inform Consultant of impending installation and obtain approval for actual location.
.3 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.
.4 Record locations of maintained, re-routed and abandoned service lines.

1.5 SUBSURFACE CONDITIONS

.1 Promptly notify Consultant in writing if discovered surface or subsurface conditions at Place of Work differ materially from those indicated in Contract Documents.
.2 Advise the Consultant of a reasonable assumption of probable conditions when determined. After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes or Change Orders.

END OF SECTION

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1 General

1.1 SUBMITTALS

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

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

1.2 MATERIALS

.1 Required for original installation.

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

1.3 PREPARATION

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

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

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

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

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

1.4 EXECUTION

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

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

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

.5 Remove samples of installed Work for testing.

.6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

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

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

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

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

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.

.12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

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

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Progressive cleaning.
.2 Cleaning prior to acceptance.

1.2 RELATED SECTIONS

.1 Section 01 77 00 - Closeout Procedures.
.2 All Sections

1.3 CLEANING MATERIALS

.1 Cleaning Agents and Materials: Low VOC content.

1.4 PROGRESSIVE CLEANING

.1 Maintain Work area in tidy condition, free from accumulation of waste products and debris, including that caused by other Contractors.
.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.
.3 Clear snow and ice from area of construction, bank or pile snow in designated areas only.
.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
.5 Containers:
    .1 Provide on-site steel framed, hinged lid containers for collection of waste materials and debris.
    .2 Provide and use clearly marked, separate bins for recycling.
.6 Remove waste material and debris from site and deposit in waste container at end of each working day.
.7 Dispose of waste materials and debris off site.
.8 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
.9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
.10 Provide adequate ventilation during use of volatile or noxious substances. Use of enclosure ventilation systems is not permitted for this purpose.
.11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
.12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.5 CLEANING PRIOR TO ACCEPTANCE

.1 Prior to applying for Substantial Performance of the Work, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
.3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
.4 Remove waste products and debris including that caused by sub contractors.
.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant.
.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors.
.9 Clean lighting reflectors, lenses, and other lighting surfaces.
.10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
.11 Clean and polish surface finishes, as recommended by manufacturer.
.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
.13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
.14 Remove dirt and other disfiguration from exterior surfaces.
.15 Clean and sweep roofs, gutters, areaways, and sunken wells.
.16 Sweep and wash clean paved areas.
.17 Clean equipment and fixtures to a sanitary condition; replace filters of mechanical equipment.
.18 Clean roof surfaces, down-spouts, and drainage components.
.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
.20 Remove snow and ice from access to facilities.

1.6 FINAL PRODUCT CLEANING

.1 Execute final cleaning prior to final project assessment.
.2 Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum soft surfaces.
.3 Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
.4 Replace filters of operating equipment.
.5 Clean site; sweep paved areas, rake clean landscaped surfaces.
.6 Remove waste and surplus materials, rubbish, and construction facilities from the site.

END OF SECTION

1 General

1.1 INSPECTION AND DECLARATION

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

.2 Consultant's Inspection:
  .1 Consultant, Owner and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:
  .1 Work has been completed and inspected for compliance with Contract Documents.
  .2 Defects have been corrected and deficiencies have been completed.
  .3 Equipment and systems have been tested, adjusted and are fully operational.
  .4 Certificates required by authorities having jurisdiction have been submitted.
  .5 Systems have been commissioned.
  .6 Operation of systems have been demonstrated to Owner's personnel.
  .7 Work is complete and ready for Final Inspection.

.4 Final Inspection:
  .1 When items noted above are completed, request final inspection of Work by Owner and Consultant. If Work is deemed incomplete by Consultant complete outstanding items and request re inspection.

.5 Declaration of Substantial Performance:
  .1 When Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Certificate of Substantial Performance. Refer to CCDC 2, General Conditions Article for specifics to application.

.6 Commencement of Lien and Warranty Periods:
  .1 Date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment:
  .1 When Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. Refer to CCDC 2. If Work is deemed incomplete by Owner, complete outstanding items and request re inspection. Cost of re inspection will be deducted from final payment.

.8 Payment of Holdback:
  .1 After issuance of Certificate of Substantial Performance of Work, submit an application of payment of holdback amount in accordance with CCDC2.

1.2 CERTIFICATE OF SUBSTANTIAL PERFORMANCE

.1 Upon approval, a Certificate of Substantial Performance will be issued to the Contractor by the Consultant. Upon receipt of fully executed certificate, a copy shall be emailed to the Owner for their records.

.2 The Certificate of Substantial Performance will establish the date of the Consultant's inspection as the date of Substantial Performance of the Contract, and will commence the required 60-day period before release of the lien holdback amount.

.3 During the 60-day period, Contractor shall continue to complete the work.

.4 The Contractor shall immediately deliver to the Consultant specified submissions upon receipt of the Certificate of Substantial Performance.

1.3 ESTABLISHMENT OF WARRANTIES

.1 Warranties shall commence at date of Substantial Performance of the Work.

1.4 CERTIFICATE FOR PAYMENT OF LIEN HOLDBACK AMOUNT

.1 The Contractor shall submit statement and supporting documents for application of Release of Lien Holdback amount. These documents include those listed in Paragraph 2.2.2 and 2.2.3 and the Statutory Declaration Form CCDC 9A.

.2 Within five working days of receipt of application for Release of Lien Holdback amount and if approved, the Consultant will prepare a Certificate for Payment of the Lien Holdback amount. This Certificate dated on the day following termination of the 60 day period will be issued to the Owner with a copy delivered to the Contractor.

.3 The Owner will before the date of this Certificate ensure that no liens related to the Contract are registered and that no notice of liens has been received at the end of the 60-day period.

.4 Should no liens exist, the Lien Holdback will be due and payable one day after termination of the 60-day period in the amount indicated on the approved application for Certificate of Substantial Performance.

.5 The Owner will review jointly with the Contractor's Insurance related to the Contract before the 60-day period is terminated to ensure that all parties are adequately covered.

1.5 TOTAL PERFORMANCE

.1 The Contractor shall inspect the work to establish its completion in accordance with the Contract Documents and when satisfied of this completion request of the Consultant a final inspection.

.2 The Consultant will compile a final deficiency list at this inspection and issue it to the Contractor and Owner.

.3 The Contractor shall correct final deficiencies before a date agreed upon by the Contractor and Consultant.

.4 When the Contractor has satisfied himself that these corrections have been completed in a satisfactory manner by his inspection, he shall schedule a re-inspection by the Consultant, and the Owner's representatives if required, within five working days of the Contractor's request.

.5 When the Consultant is satisfied that all deficiencies have been rectified and the work is complete, the Contractor shall submit an application for the final progress payment.

.6 When "seasonal deficiencies", as determined by the Owner and/or Consultant exist, a sum of money will be withheld in accordance with the requirements of CCDC2 2020-GC5.6.

1.6 WARRANTY PERIOD

.1 The Owner will advise the Consultant of defects observed during Warranty periods.

.2 The Consultant will notify the Contractor of these defects and request him to remedy the defects in accordance with the Contract Documents.

.3 Thirty (30) days before expiration of Warranties the Owner's representatives, the Consultant and the Contractor will review the work as arranged by the Contractor noting defects of products and workmanship.

.4 The Contractor shall immediately remedy such noted defects.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Project Record Documents as follows:
  .1 As-Built drawings;
  .2 As-Built specifications;
  .3 Reviewed shop drawings.
.2 Operations and Maintenance data as follows:
  .1 Operations and Maintenance Manual;
  .2 Maintenance Materials;
  .3 Spare Parts;
  .4 Special Tools.

1.2 PROJECT RECORD DOCUMENTS

.1 Contractor to provide two (2) white print sets of contract drawings and two copies of Specifications Manual specifically for "as-built" purposes.
.2 Maintain at site one set of the contract drawings and specifications to record actual as-built site conditions.
.3 Maintain up-to-date, real time as-built drawings and specifications in good condition and make available for inspection by the Consultant at any time during construction.
.4 As-Built Drawings:
  .1 Record changes in red ink on the prints. Mark only on one set of prints and at completion of project and prior to interim inspection, neatly transfer notations to second set (also by use of red ink). Submit both sets to Consultant. All drawings of both sets shall be stamped "As-Built Drawings" and be signed and dated by Contractor.
  .2 Show all modifications, substitutions and deviations from what is shown on the contract drawings or in specifications.
  .3 Record following information:
    .1 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure;
    .2 Field changes of dimension and detail;
    .3 Location of all capped or terminated services and utilities.
    .4 Chases for mechanical, electrical and other services;
    .5 Ceiling and floor elevations;
    .6 Reflected ceiling plan condition showing finished layout of all ceiling-mounted services and devices;
    .7 Plumbing, heating, air conditioning and ventilation, sprinkler and electrical service installation locations; all to be dimensioned and referenced to building columns or load bearing walls;
    .8 All design elevations, sections, floor plans and details dimensioned and marked-up to consistently report finished installation conditions;
    .9 Any details produced in the course of the contract by the Consultant to supplement or to change existing design drawings must also be marked-up and dimensioned to reflect final as-built conditions and appended to the as-built drawing document;
    .10 All change orders issued over the course of the contract must be documented on the finished as-built documents, accurately and consistently depicting the changed condition as it applies to all affected drawing details.
.5 As-built Specifications: legibly mark in red each item to record actual construction, including:
  .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly items substituted from that specified.
  .2 Changes made by Addenda and Change Orders.

.3 Mark up both copies of specifications; stamp "as-built", sign and date similarly to drawings as per above clause.

.6 Maintain As-built documents current as the contract progresses. Consultant will conduct reviews and inspections of the documents on a regular basis. Frequency of reviews will be subject to Consultant's discretion. Failure to maintain as-builts current and complete to satisfaction of the Consultant shall be subject to financial penalties in the form of progress payment reductions and holdback assessments.

1.3 REVIEWED SHOP DRAWINGS

.1 Compile full set of shop drawings and product data reviewed on project and incorporate into Operations and Maintenance Manual.

.2 Submit shop drawing sets at same time and as part of the contents of the Operation and Maintenance manuals specified in this section.

1.4 OPERATIONS AND MAINTENANCE MANUALS

.1 Definition: an organized compilation of operating and maintenance data including detailed technical information, documents and records describing operation and maintenance of individual products or systems as specified in individual sections of the specifications.

.2 Manual Language: final manuals to be in English language.

.3 Submit Operations and Maintenance (O&M) Manuals in PDF format only. Provide complete, organized, searchable PDF files containing all required operating instructions, maintenance procedures, product data, warranties, parts lists, and other applicable closeout documentation..

.1 Organize manuals by specification section and equipment or system, including a table of contents and bookmarks to facilitate navigation..

.2 Submit one draft PDF copy to the Consultant for review. Revise and resubmit as directed..

.3 Upon review and acceptance by the Consultant, submit one final PDF copy incorporating all required revisions for distribution to the Owner. Hard copies are not required.

.4 Submission Date: submit complete operation and maintenance manual to Consultant two weeks prior to Substantial Performance of the project.

.5 Manual Contents:

.1 Cover sheet containing:

.1 Date submitted.

.2 Project title, location and project number.

.3 Names and addresses of Contractor, and all Sub-contractors.

.2 Table of Contents: provide full table of contents.

.3 List of maintenance materials.

.4 List of spare parts.

.5 List of special tools.

.6 Original or certified copy of Warranties and Guarantees.

.7 Copies of approvals, and certificates issued by Inspection Authorities.

.8 Copies of reports and results from tests designated as Contractor's responsibilities.

.9 Product Information Data on all materials, equipment and systems as specified in individual sections of the specifications to include:

.1 List of equipment including manufacturer's name, supplier, local source of supplies and service depot(s). Provide full addresses and telephone numbers.

.2 Nameplate information including equipment number, make, size, capacity, model number and serial number.

.3 Parts list.

.4 Installation details.

.5 Operating instructions.

.6 Maintenance instructions for equipment.
.7 Maintenance instructions for finishes.

.6 Shop drawings:
.1 Include reviewed shop drawings in the electronic Operations and Maintenance (O&M) Manual in PDF format..
.2 Organize shop drawings by specification section and the equipment or system to which they relate..
.3 Where the volume of shop drawing data is substantial, compile the drawings into separate, clearly labelled PDF files, organized by specification section or system, with bookmarks and cross-references to facilitate navigation.
.4 Hard copies and physical binding are not required.

.7 Equipment and Systems Data: the following list indicates the type of data and extent of information required to be included for each item of equipment and for each system:
.1 Description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
.3 Include installed color coded wiring diagrams.
.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include seasonal and any special operating instructions.
.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
.6 Servicing and lubrication schedule, and list of lubricants required.
.7 Manufacturer's printed operation and maintenance instructions.
.8 Sequence of operation by controls manufacturer.
.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
.10 Provide installed control diagrams by controls manufacturer.
.11 Provide Contractor's coordination drawings, with installed color coded piping diagrams.
.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
.14 Include test and balancing reports.
.15 Additional requirements as specified in individual specification sections.

.8 Materials and Finishes Maintenance Data:
.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and color and texture designations.
.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
.4 Additional Requirements: as specified in individual specifications sections.

1.5 SPARE PARTS, TOOLS AND MAINTENANCE MATERIALS

.1 Provide spare parts, special tools and extra materials for maintenance purposes in quantities specified in individual specification sections.
.2 Tag all items with associated function or equipment.

.3 Provide items of same manufacture and quality as items in Work.
.4 Deliver to site in well packaged condition. Store in location as directed by Consultant.
.5 Clearly mark as to contents indicating:
  .1 Part number.
  .2 Identification of equipment or system for which parts are applicable.
  .3 Installation instructions or intended use as applicable.
  .4 Name, address and telephone number of nearest supplier.
.6 Prepare and submit complete inventory list of items supplied. Include list within Maintenance Manual.
.7 Turnover to Facility Manager and obtain signature. Include receipt with Maintenance Manual.

1.6 SPECIAL TOOLS

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

1.7 CLOSEOUT SUBMITTALS

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
.2 Copy will be returned after final inspection, with Consultant's comments.
.3 Revise content of documents as required prior to final submittal.
.4 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, three final hard copies and one electronic final copy (PDF) of operating and maintenance manuals in English.
.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
.6 If requested, furnish evidence as to type, source and quality of products provided.
.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
.8 Pay costs of transportation.
.9 Failure to deliver maintenance materials, spare parts, special tools and as-builts will delay progress payments.

1.8 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;
  .1 date of submission; names,
  .2 addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;
  .3 schedule of products and systems, indexed to content of volume.
.2 For each product or system:
  .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control and Section 01 77 00 - Closeout Procedures.

1.9 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on 2 sets of white print, opaque drawings, and in copy of Project Manual.

.2 Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.
.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
  .1 Measured depths of elements of foundation in relation to finish first floor datum.
  .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  .4 Field changes of dimension and detail.
  .5 Changes made by change orders.
  .6 Details not on original Contract Drawings.
  .7 References to related shop drawings and modifications.
.5 Specifications: legibly mark each item to record actual construction, including:
  .1 Manufacturer, trade name, and catalog number of each product actually installed, particularly optional items and substitute items.
  .2 Changes made by Addenda and change orders.
.6 Other Documents: maintain manufacturer's certifications, required by individual specifications sections.

1.10 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
.2 Store in original and undamaged condition with manufacturer's seal and labels intact.
.3 Store components subject to damage from weather in weatherproof enclosures.
.4 Store paints and freezable materials in a heated and ventilated room.
.5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.11 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
.2 List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
.3 Obtain warranties and bonds, executed in duplicate by Subcontractors, suppliers, and manufacturers where specifically requested by individual specification sections, within ten days after completion of the applicable item of work.
.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
.5 Verify that documents are in proper form, contain full information, and are notarized.
.6 Co-execute submittals when required.
.7 Retain warranties and bonds until time specified for submittal.

END OF SECTION

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1 General

1.1 SECTION INCLUDES

.1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.
.2 Seminars and demonstrations.

1.2 PRECEDENCE

.1 Division 01 - General Requirements Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 RELATED SECTIONS

.1 Division 21 - Fire Suppression.
.2 Division 22 - Plumbing.
.3 Division 23 - Heating Ventilating and Air Conditioning.
.4 Division 25 - Integrated Automation.
.5 Division 26 - Electrical.
.6 Division 27 - Communications.
.7 Division 28 - Electronic Safety & Security.
.8 Appendix 'E' - Commissioning Plan.
.9 Training Plan

1.4 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two (2) weeks prior to date of substantial performance.
.2 Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.
.3 It will be the General Contractor's responsibility to video record all training sessions. These video recordings to be included with the O&M manuals.

1.5 COMPONENT DEMONSTRATION

.1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.
.2 Instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.6 SUBMITTALS

.1 Submit schedule of time and date for demonstration of each item of equipment and each system four (4) weeks prior to designated dates, for Consultant's approval.
.2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
.3 Give time and date of each demonstration, with list of persons present.

1.7 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with requirements of the Commissioning Plan.
.2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 00 - Commissioning and equipment and systems are fully operational.
.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions. These are to be submitted to the Consultant a minimum of 4 weeks prior to training.

2 Products

2.1 NOT APPLICABLE

.1 Not applicable.

3 Execution

3.1 PREPARATION

.1 Verify that suitable conditions for demonstration and instructions are available.
.2 Verify that designated personnel are present.
.3 Prepare agendas and outlines.
.4 Establish seminar organization.
.5 Explain component design and operational philosophy and strategy.
.6 Develop equipment presentations.
.7 Present system demonstrations.
.8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 PREPARATION OF AGENDAS AND OUTLINES

.1 Prepare agendas and outlines including the following:
  .1 Equipment and systems to be included in seminar presentations.
  .2 Name of companies and representatives presenting at seminars.
  .3 Outline of each seminar's content.
  .4 Time and date allocated to each system and item of equipment.
  .5 Provide separate agenda for each system.

3.3 SEMINAR ORGANIZATION

.1 Coordinate content and presentations for seminars.
.2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.
.3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.
.4 Coordinate proposed dates for seminars with Owner and select mutually agreeable dates.

3.4 EXPLANATION OF DESIGN STRATEGY

.1 Explain design philosophy of each system. Include following information:
  .1 An overview of how system is intended to operate.
  .2 Description of design parameters, constraints and operational requirements.
  .3 Description of system operation strategies.

3.5 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.
.2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
.3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.
.4 Review contents of manual in detail to explain all aspects of operation and maintenance.
.5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

3.6 TIME ALLOCATED FOR INSTRUCTIONS

.1 Ensure amount of time required (as a minimum requirement) for instruction of each item of equipment or system follows as:

SECTION	SECTION NAME	TIME (HRS)
21 13 16	Dry Pipe Sprinkler Systems	2 hrs
21 22 00	Clean Agent Fire Extinguishing System	2 hrs
22 05 00	Plumbing	2 hrs
23 34 00	HVAC Fans	2 hrs
23 72 00	Air to Air Recovery Equipment	2 hrs
23 84 13	Humidifiers	2 hrs
25 01 11	EMCS	8 hrs
26 32 13.04	Diesel Electric Generating Units	4 hrs
26 33 53	Uninterruptible Power Systems Static	2 hrs
26 36 23	Automatic Transfer Switches	2 hrs
26 50 00	Lighting	3 hrs
26 52 00	Emergency Lighting	1 hrs
27 52 24	Nurse Call System	3 hrs
28 31 02	Multiplex Fire Alarm System	3 hrs

END OF SECTION

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1 General

1.1 COMMISSIONING OBJECTIVE

.1 Perform commissioning activities in order to achieve the following objectives:
  .1 Collect data on equipment and systems supplied; and to document their installation;
  .2 Conduct checks and tests on fully installed building component, equipment, systems and integrated systems to:
    .1 Verify whether they operate in accordance with requirements of Contract Documents;
    .2 Verify performance against design criteria and user requirements and measure peak capacities;
  .3 Prepare a Building Management Manual (BMM) which contains operations and maintenance data, as-built record documents, commissioning reports, training data and other critical information for future use by Facility operational staff;
  .4 Ensure transfer of knowledge on the operations, maintenance and management of the Facility to Owner and Operational personnel by means of appropriate training.

.2 Commissioning activities conducted by Owner and/or Consultant does not replace checks, tests, adjustments, balancing and other performance verification responsibilities to be performed by Trade Contractor as part of the work and as specified in other sections of the Specifications.

1.2 DEFINITIONS

.1 For the purpose of this contract, the following terms, used in this section, as they relate directly or indirectly to the commissioning process, shall be deemed to have the meaning as defined hereafter.

.2 Commissioning Process: a planned program of tasks, activities and procedures carried out systematically during the Construction and Occupancy Stages in accordance with the commissioning objectives, specified in clause 1.2 above, to:
  .1 Verify whether the fully installed equipment, systems and integrated systems operate in accordance with Contract Documents, design criteria, manufacturers' recommendations and;
  .2 Ensure that appropriate documentation is compiled to effectively train Operation and Maintenance staff and prepare a comprehensive Building Management Manual (BMM).

.3 Commission (ie: to commission a building component or system): tests and checks conducted on all systems and integrated systems of Facility; carried out only after they are fully installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.
  .1 Contractor provides assistance during this process by operating equipment and systems, by troubleshooting and making adjustments as may be required.
  .2 Systems are run under their full operation and under various modes to determine if they function correctly, consistently, at peak efficiency and interactively with each other as intended in accordance with Contract Documents, design criteria and manufacturers' recommendations.
  .3 During these checks, adjustments may be made enhancing performance to meet environmental or user requirements.

.4 Contractor: means the Contractor, however it also refers to any personnel from Subcontractors, including the controls subcontractors, suppliers and certified manufacturer technicians with whom the Contractor contracts or obtains services for the performance of work and designated commissioning duties.

.5 Consultant: persons from the civil, architectural, mechanical and electrical design disciplines of the consultant firm(s) engaged by Owner to prepare the final design and contract documents.

.6 Design Criteria: All those factors included in the design of a Facility prescribed by the tenant needs or as determined by Consultant as necessary in order to meet all Facility functional and user operational requirements.

.7 Installation/Start-up Checks: (sometimes referred to as pre-functional checks). Checks and inspections to be performed by Contractor during the pre-start-up and start-up of a particular equipment or system component.

.1 Checklist sheets are produced which include the following data:

.1 Product manufacturer's installation instructions and recommended checks and;

.2 Special procedures as specified in relevant sections of Specifications;

.3 Other items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Standard Installation/Start-up Checklist sheets prepared by equipment manufacturer are acceptable for use. Supplement with additional data representative of specific project conditions as deemed required by Consultant.

.3 Use Checklist sheets for all equipment installation. Document in writing on checklist the various checks made, deficiencies noted and corrective action taken.

.4 Installing Sub-Contractor and/or certified manufacturers technicians, to sign Checklist sheets upon completion, certifying that stated checks and inspections have been performed.

.8 Performance Verification: (sometimes referred to Functional Testing) checks, running dynamic tests and adjustments carried out by Contractor on equipment and systems, upon their installation, to ensure they operate correctly, efficiently and function independently and interactively with other systems as intended in accordance with contract documents and manufacturer's recommendations.

.1 Performance Verification shall not be considered part of the commissioning process. It is however considered an essential and integral part of Contractor's responsibilities in the equipment installation process which must be stringently conducted, successfully completed and approved by Owner before a piece of equipment or system is considered fully installed and functional.

.2 Facility components and systems will not be commissioned until performance verification has been completed and approved.

.9 Product Information (PI Data): a compilation of data gathered on a particular piece of equipment, typically produced by manufacturer, which includes nameplate information, installation/startup instructions, parts list, operating instructions, maintenance guidelines and other pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of such equipment. This documentation is included in the Building Management Manual (BMM) at completion of work.

1.3 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

.1 General:

.1 Coordinate the participation of the various subcontractors, their specialists and manufacturer's certified technicians in providing the commissioning activities described below.

.2 Workers and manufacturer's certified technicians are to be knowledgeable and qualified to interpret system functions and intended design criteria.

.3 Develop a commissioning schedule.

.4 Notify Consultant in writing when Facility is ready to be commissioned. Give 14 calendar day notice.

.5 Commissioning of Facility and designated systems will only commence once that required documentation has been received and all installed equipment and systems have undergone successful performance verification.

.6 Be aware that inspection certificate will only be issued by Consultant when:

.1 All commissioning documentation has been received, reviewed for suitability and approved by Consultant;
.2 Designated facility components and systems have been commissioned and;
.3 Training has been completed.

.7 Non-Conformance of Performance Verification Requirements:
.1 Should incorrectly installed or malfunctioning equipment, system components or associated controls be found while Facility is being commissioned, Contractor shall be required to re-verify 100% of all equipment and components within the non-functional system, including other related system as deemed required by Consultant, to correct deficiencies and ensure effective performance of the fully functional system as designed.
.2 Costs to correct work and any additional tests or inspections, as deemed required by Consultant, to determine acceptability and proper performance of such items to be paid for by Contractor.
.1 Above costs held against Contractor will be as financial penalties in the form of progress payment reductions or holdback assessments.

.2 Prior to Facility being Commissioned:
.1 Submit commissioning documentation as specified in clause 1.8 for use during commissioning.
.2 Carryout pre-start-up and start-up of equipment.
.3 Conduct performance verification on all installed equipment and systems. Ensure they are fully functional.
.4 Address deficiencies in Work identified during performance verification of equipment and systems. Conduct additional performance verification checks and tests to ensure acceptability of Work.
.5 Arrange for special tools, devices and services, identified at commissioning meeting(s), as deemed required to assist with commissioning.
.6 Provide access ladders, two way radios and other equipment required by Team when facility will be commissioned.

.3 When Facility is being Commissioned:
.1 Provide qualified tradespersons to be present at site to assist commissioning activity.
.2 Assist in commissioning architectural and structural building component, and mechanical, electrical and civil systems specified and as follows:
.1 Operate designated building component, mechanical/electrical equipment and system under all modes of operation and conduct checks and tests as directed by Consultant.
.2 Check and verify that building component, equipment, systems and integrated systems, including their controls, are functioning and responding correctly and interactively with each other.
.3 Test systems independently and then in unison with other related systems.
.4 Conduct all Commissioning checks and tests in presence of and witnessed by Consultant.
.3 Specific procedures used to commission Facility may be provided by Consultant which includes:
.1 Sequential order of building component and system to be tested.
.2 Running systems under various anticipated modes and demands (example: high and low cooling or heating loads, duplicating outside temperature conditions, fire alarm and power failure conditions etc...).
.3 Running building controls through all sequences of operation to verify and confirm that equipment and systems are responding as designed and intended.
.4 Operating designated equipment at peak capacities, recording output data against design criteria.
.4 Run component or systems as long as necessary to effectively commission all items as deemed required by Consultant.

.5 Monitor equipment and system responses.
.6 Record test results, measurements and other data.
.7 Assist in analyzing results. Identify system deficiencies and components not responding as intended.
.8 Correct deficiencies and system non-conformance issues. Adjust, calibrate or fine tune system components as required. Debug system software as may be required.
.9 Retest systems when directed to confirm compliance.

.4 Upon completion of Facility Commissioning:
.1 Provide training to Maintenance & Operational personnel as specified in clause 1.7 below.
.2 Turn over any filled-in checks sheets, reports or signed and dated certificates resulting from commissioning.

.5 During Warranty period at Occupancy Stage:
.1 Fine tune components, systems and integrated systems and continue system debugging to optimize Facility performance.
.2 Rectify warranty issues.
.3 Submit written report to Consultant.
.1 Indicate results noted and corrective action taken.
.2 Note improvements made to operating parameters and control settings.
.3 Recommend modifications deemed advisable to improve performance, environmental conditions, energy consumptions and other issues.
.4 Consultant to be present during such work.

1.4 COMMISSIONING MEETINGS

.1 Convene commissioning meetings following project meetings: as required through the project to coordinate commissioning requirements.
.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to commissioning.
.3 Continue commissioning meetings on regular basis until commissioning deliverables have been addressed.
.4 At 60% construction completion stage. Contractor to call a separate commissioning scope meeting to review progress including Consultant, discuss schedule of equipment start-up activities and prepare for commissioning. Issues at meeting to include:
.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
.5 Thereafter commissioning meetings to be held until project completion and as required during equipment start-up and functional testing period.
.6 Meeting will be chaired by Contractor, who will record and distribute minutes within 3 business days.
.7 Ensure Subcontractors and relevant manufacturer representatives are present at subsequent commissioning meetings and as required.

1.5 COMMISSIONING SCHEDULE

.1 Address commissioning activities within the construction work schedule. Clearly identify allocated time period for commissioning and training activities.
.2 Provide a commissioning schedule at the 60% construction stage in order that specific issues and individual details of commissioning can be reviewed, discussed and dealt with from that period onward to project completion. Submit updates thereafter.
.3 Indicate allocated time period and anticipated dates for:
.1 Submission of commissioning documentation, including O&M Manuals.
.2 Equipment and system start-up and performance verification, making them ready to be commissioned.
.3 Allocated period to commission designated building components and systems.

.4 Training period.
.5 Work during Warranty period.

.4 Submit schedule to Consultant for review.

.5 Day-to-day operations are to be maintained throughout the facility during the work and activities which may be potentially disruptive are to be included in the schedule. After hours and / or overtime work may be required to facilitate day-to-day operations throughout the facility and should be included in the schedule.

1.6 INSTRUCTORS

.1 Contractor and certified factory-trained manufacturers' personnel to provide instruction on the following:
.1 Start-Up, operation, shut-down of equipment, components and systems.
.2 Control features, reasons for, results of, implications on associated systems of, and adjustment of set points of control and safety devices.
.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.2 Contractor and equipment manufacturer to provide instruction on:
.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.7 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:
.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
.2 Effective on-going inspection, measurements of system performance.
.3 Proper preventive maintenance, diagnosis and trouble-shooting.
.4 Ability to update documentation.

.2 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.8 TRAINING MATERIALS

.1 Contractor to be responsible for content and quality.

.2 Training materials to include:
.1 "As-Built" Contract Documents.
.2 Operating Manual.
.3 Maintenance Manual.
.4 Management Manual.
.5 Testing, Adjusting and Balancing, Performance Verification Reports and Certificates.

.3 Training materials to be in a format that permits future training procedures to same degree of detail.

.4 Supplement training materials:
.1 Multimedia presentations.
.2 Manufacturer's training videos.

.5 Equipment models.

1.9 RESPONSIBILITIES

.1 Be responsible for:
.1 Implementation of training activities,
.2 Coordination among instructors,
.3 Quality of training, training materials,

.2 Consultant will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Consultant.
.1 Report to include a list of all attendees.

1.10 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.
.2 Content includes:
  .1 Review of facility and occupancy profile.
  .2 Functional requirements.
  .3 System philosophy, limitations of systems and emergency procedures.
  .4 Review of system layout, equipment, components and controls.
  .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
  .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
  .7 Maintenance and servicing.
  .8 Trouble-shooting diagnosis.
  .9 Inter-Action among systems during integrated operation.
  .10 Review of O&M documentation.
.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.11 VIDEO-BASED TRAINING

.1 Manufacturer's videotapes to be used as training tool with Consultant's review and written approval 3 months prior to commencement of scheduled training.
.2 On-Site training videos:
  .1 Videotape training sessions for use during future training.
  .2 To be performed after systems are fully commissioned.
  .3 Organize into several short modules to permit incorporation of changes.
.3 Production methods to be professional quality.

1.12 TRAINING

.1 Commence process of familiarizing O&M personnel in the early stages of work on purpose and operation of various equipment and systems. Continue process throughout the entire construction duration.
  .1 Provide informal briefings during occasional site visits, at planned commissioning meetings and during the final commissioning site activities.
.2 Conduct formal demonstration and training sessions only after all identified systems have been commissioned and Consultant has given approval to proceed with the training process.
.3 Provide training and demonstration on equipment, sub-systems, systems and integrated systems.
.4 Carryout training in accordance with requirements of Section 01 91 13 - General Commissioning Requirements.
.5 Submit written agenda of training session(s) 4 weeks before hand for review by Consultant.
.6 Submit training manuals for review 2 weeks prior to actual training.
.7 Ensure required tools and O&M Manuals are on site for training and system demonstration.
.8 As a minimum, the training sessions to cover the following information:
  .1 Introduction.
  .2 Description of the system with factory personnel being involved at appropriate times.
  .3 Instructions on start-up procedures including seasonal procedures, system check-lists and emergency procedures.
  .4 Operational procedures, including occupancy considerations, seasonal change-over, manual and automatic operations and emergency modes.
  .5 Instruction on system shutdowns, including checklists.
  .6 Instructions on all aspects of system maintenance, including routine servicing, lubrication, overhaul and factory servicing.
  .7 Information concerning the scope of warranties and their use.

.8 A description of spare parts in stock and their service.
.9 A description of normal tools required for servicing the systems/equipment.

.9 Submit typewritten record of training sessions given and list of attendees. Use forms of format approved by Consultant.

1.13 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of final inspection.
.2 Owner will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

1.14 QUALITY CONTROL

.1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.
.2 Obtain signature from attendees and provide a copy in the Building Maintenance Manual.

1.15 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Consultant's approval.
.3 Submit reports and certificates within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
.4 Record signatures of all attendees.
.5 Give time and date of each demonstration, with list of persons present.

1.16 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with respective applicable Sections.
.2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.
.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.17 PREPARATIONS

.1 Verify that conditions for demonstration and instructions comply with requirements.
.2 Verify that designated personnel are present.

1.18 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, sequencing, winter/summer operating, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.
.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
.3 Review contents of manual in detail to explain aspects of operation and maintenance.
.4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.19 COMMISSIONING DOCUMENTATION

.1 Submit the following documentation for use during commissioning and for incorporation thereafter into a Building Management Manual (BMM).

.2 Operations and Maintenance Manuals, Project Record Documents and other data as specified in Section 01 78 00 - Closeout Submittals. Data to include:
  .1 Equipment Product Information (PI Data) complete with:
    .1 Nameplate info,
    .2 Installation instructions,
    .3 Operating procedures and
    .4 Maintenance guidelines.
    .5 Reviewed shop drawings,
    .6 As-built record drawings and Specifications.
  .2 Completed Installation/Start-up Checklist sheets used.
  .3 Copy of any static and dynamic test and reports conducted.
  .4 Reports as specified in various trade sections.
.3 Documentation to include detailed information and number of copies as specified for maintenance manuals of Section 01 78 00 - Closeout Submittals.

END OF SECTION

1 General

1.1 DESCRIPTION OF WORK

.1 The work of this Section comprises the furnishing of all labour, materials and equipment necessary for all demolition work required to complete the Work of this Contract in accordance with the requirements of this Section and as shown on the Drawings, which includes, but is NOT necessarily limited to:

.1 Removal and reinstatement of items which are attached to the building to facilitate the execution of work.

1.2 PROTECTION

.1 Size, depth and location of existing utilities and structures as indicated are for guidance only; completeness and accuracy are not guaranteed.

.2 Protect existing items designated to remain. In event of damage, immediately replace such items or make repairs to approval of Consultant and at no additional cost to the Owner.

.3 Protect existing surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.

.4 Prevent movement, settlement or damage of adjacent utilities and structures. Provide bracing, shoring and underpinning required. Make good damage and be liable for injury caused by demolition.

.5 If safety of structure being repaired or adjacent structures appear to be endangered, cease operations and notify Consultant and Owner. Take precautions to support structures.

.6 Maintain and protect from damage, all structures, utilities encountered during the execution of Work. Obtain direction of Consultant before moving or otherwise disturbing utilities or structures.

.7 Record in accordance with requirements of Division 01 - General Requirements, locations of maintained, re-routed and abandoned underground lines.

.8 Make good and pay for damage to any lines resulting from work.

1.3 SAFETY CODE

.1 Carry out demolition work in accordance with ALL applicable codes and regulations and as outlined in Division 01 - General Requirements.

2 Products

2.1 NOT APPLICABLE

.1 Not applicable.

3 Execution

3.1 PREPARATION

.1 Inspect building and site and verify items designated for removal and items to be preserved.

.2 Locate and protect all utility services.

.3 Any damage to existing utilities and services shall be immediately repaired to the satisfaction of the Owner.

3.2 REMOVAL OF SALVAGED ITEMS

.1 Remove items designated for salvage and stockpile on site or inside building as designated by Owner.

.2 Items not designated for salvage and re-use shall be removed and dispose of off-site by the Contractor.

3.3 DISPOSAL OF MATERIAL

.1 Dispose of all removed materials off-site.
.2 Pay all fees that may be charged to dispose of materials at licensed disposal sites.
.3 Remove all material contaminated with oil, gasoline, calcium chloride or other toxic or dangerous materials and dispose of in manner to minimize danger at site and to a location off site approved by Provincial Authority governing such disposal.

3.4 RESTORATION

.1 Upon completion of work, remove debris, trim surfaces and leave work site clean.
.2 Reinstate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 American Concrete Institute (ACI)
- .1 ACI 315R-2018, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.
- .2 American National Standards Institute/American Concrete Institute (ANSI/ACI)
  - .1 ANSI/ACI 315-99, Details and Detailing of Concrete Reinforcement.
- .3 American Society for Testing and Materials (ASTM)
  - .1 ASTM A775 / A775M-91c, Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4 Canadian Standards Association (CSA)
  - .1 CSA A23.1:24/CSA A23.2:24, Concrete Materials and Methods of Concrete Construction.
  - .2 CAN3-A23.3-19, Design of Concrete Structures for Buildings.
  - .3 CSA G30.3-M1983 (R1998), Cold Drawn Steel Wire for Concrete Reinforcement.
  - .4 CSA G30.5-M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
  - .5 CSA G30.14-M1983 (R1998), Deformed Steel Wire for Concrete Reinforcement.
  - .6 CSA G30.15-M1983 (R1998), Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
  - .7 CSA G30.18:21, Billet-Steel Bars for Concrete Reinforcement.
  - .8 CAN/CSA-G40.21-13, Structural Quality Steels.
  - .9 CAN/CSA-G164-18 (2023), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .10 CSA W186-2021, Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.

.2 Upon request inform Consultant of proposed source of material to be supplied.

1.4 SHOP DRAWINGS

.1 Submit shop drawings including placing of reinforcement in accordance with Division 01 - General Requirements.

.2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada, ANSI/ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.

.3 Detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated. Provide type A tension lap splices where indicated.

.4 Each shop drawing submitted shall bear stamp and signature of qualified professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Consultant.
.2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
.3 Cold-drawn annealed steel wire ties: to CSA G30.3.
.4 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.
    .1 All 152 x 152 MW x 18.7 x 18.7
.5 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
.6 Mechanical splices: subject to approval of Consultant.
.7 Steel Fiber: DRAMIX 3D 55 / 60 to Manufacturers recommendations.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ANSI/ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada. ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise.
.2 Obtain Consultant's approval for locations of reinforcement splices other than those shown on placing drawings.
.3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.
.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement 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 which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.
.2 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.
.3 Prior to placing concrete, obtain Consultant's approval of reinforcing material and placement.
.4 Ensure cover to reinforcement is maintained during concrete pour.
.5 Protect epoxy coated portions of bars with covering during transportation and handling.
.6 Provide concrete half-bricks to support welded wire mesh in proper position in floor slabs during placing of concrete.

3.3 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 20 00 - Concrete Reinforcing.
.2 Section 03 35 00 - Concrete Finishing.
.3 Section 05 50 00 - Metal Fabrications.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)
  .1 ASTM C109/C109M-16, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).
  .2 ASTM C260-10a (2016), Specification for Air-Entraining Admixtures for Concrete.
  .3 ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  .4 ASTM C332-17, Specification for Lightweight Aggregates for Insulating Concrete.
  .5 ASTM C494-17, Specification for Chemical Admixtures for Concrete.
  .6 ASTM C827-16, Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
  .7 ASTM C939-16a, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.
  .8 ASTM D1751-04 (2013), Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
  .9 ASTM D1752-04a (2013), Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-51.34-M86, Vapor Barrier, Polyethylene Sheet for Use in Building Construction.
.3 Canadian Standards Association (CSA)
  .1 CAN/CSA-A3000-18, Cementitious Materials Compendium.
  .2 CSA A23.1:24, Concrete Materials and Methods of Concrete Construction.
  .3 CSA A23.2:24, Methods of Test for Concrete.

1.3 CERTIFICATES

.1 Submit certificates in accordance with Division 01 - General Requirements.
.2 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.
.3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Division 01 - General Requirements.
.2 Pre-Pour Meeting
  .1 Convene a pre-pour meeting 2 weeks prior to beginning concrete works.
  .2 Ensure concrete forming, finishing and concrete supplier personnel, attend.
  .3 Verify project requirements.
  .4 Review all aspects of the work including construction sequence, access to work by other Trade Contractors, Quality of falsework for trueness to dimensions, quality of finish expected at exposed concrete and all other aspects of the work.
.3 Submit to Consultant, minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
.4 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Consultant on following items:
  .1 Falsework erection.

.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.
.5 Finishes.
.6 Formwork removal.
.7 Joints.

1.5 ENVIRONMENTAL CONDITIONS

.1 Provide all protection during concrete placing and curing in hot and in cold weather, and to CAN/CSA-A23.1, Clause 21.
.2 Prior to placing, ensure that all needed material and equipment is on hand, and obtain the Consultant's approval for particular methods to be used.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.
.4 Use excess concrete for: additional paving, post footing anchorage, swale rip-rap reinforcing, mud slab, flowable fill, retaining wall footing ballast, storm structure covers, underground utility pipe kickers, storm pipe flared end section, toe wash protection, shoulder and toe outfall restraints for temporary erosion pipes.
.5 Use trigger operated spray nozzles for water hoses.
.6 Designate a cleaning area for tools to limit water use and runoff.
.7 Carefully coordinate the specified concrete work with weather conditions.
.8 Ensure emptied containers are sealed and stored safely for disposal.
.9 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
.10 Choose least harmful, appropriate cleaning method which will perform adequately.

2 Products

2.1 MATERIALS

.1 Portland cement: to CAN/CSA-A5.
.2 Blended hydraulic cement: to CSA A362-98.
.3 Supplementary cementing materials: to CAN/CSA-A23.5.
.4 Cementitious hydraulic slag: to CAN/CSA-A363.
.5 Water: to CAN/CSA-A23.1.
.6 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.
.7 Air entraining admixture: to CSA CAN3 - A 266.1
.8 Chemical admixtures: to CSA CAN3 - A 266.2 Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.
.9 Shrinkage compensating grout: premixed compound consisting of metallic aggregate, Portland cement, water reducing and plasticizing agents.
    .1 Compressive strength: 50 MPa at 28 days.
    .2 Consistency:
        .1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30s.
        .2 Flowable: to ASTM C827. Flow table, 5 drops in 3s, (ASTM C109, applicable portion) 125 to 145%.

.3 Plastic: to ASTM C827. Flow table, 5 drops in 3s, (ASTM C109, applicable portions) 100 to 125 %.
.4 Dry pack to manufacturer's requirements.
.3 Net shrinkage at 28 days: maximum nil %.

.10 Curing compound: to CAN/CSA-A23.1 white and to ASTM C309, Type 1-chlorinated rubber. Coordinate with finish floor materials for compatibility.

.11 Premoulded waterstops: bentonite and polyethylene sandwich, minimum 19mm thickness x 25mm wide, water-activated, expanding type forming compression seal.
.1 Acceptable Material:
.1 Parastop.
.2 Volclay Waterstop-RX.
.3 Hydrotite.

.12 Ribbed waterstops: extruded PVC, 150mm long, flanges tapered 6.3mm to 9.5mm at center bulb with pre-welded corners and intersecting pieces to following properties:
.1 Tensile strength: to ASTM D412, Die C method, minimum 11.4MPa.
.2 Elongation: to ASTM D412, Die C method, minimum 275%.
.3 Tear resistance: to ASTM D624, Die B method minimum 48 kN/m.
.4 Acceptable Material:
.1 W.R. Meadows Sealtight No. 6380.
.2 CPD No. 5.

.13 Labyrinth waterstops: extruded PVC Arctic Grade of sizes indicated with prewelded corner and intersecting pieces.
.1 Tensile strength: to ASTM D412, method A, Die "C".
.2 Elongation: to ASTM D412, method A, Die "C", minimum 250%.
.3 Tear resistance: to ASTM D624, method A, Die "B", minimum 30 kN/m.

.14 Premoulded joint fillers:
.1 Bituminous impregnated fiber board: to ASTM D1751.

.15 Weep hole tubes: galvanized steel or plastic.

.16 Dampproofing:
.1 Refer to Section 07 11 13 - Bituminous Dampproofing.

.17 Polyethylene film: 10 mil thickness to CAN/CGSB-51.34.

.18 Joint Sealer: chemical curing, multi-component, Class B, Type I for horizontal joints, Type II for vertical joints to CAN/CGSB 19.24.

.19 Under Slab Vapour Barrier: see Section 31 23 00 - Excavation and Fill.

.20 The use of super plastizer for the structural slab and retaining wall is acceptable provided it meets the requirements of CAN/CSA-A23.1.

2.2 MIXES

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give following properties:
.1 Concrete floor slabs, on grade:
.1 Cement: use Type 10 Portland cement.
.2 Minimum compressive strength at 28 days: 25 MPa.
.3 Class of exposure: N.
.4 Nominal size of coarse aggregate: 20mm.
.5 Slump at point and time of discharge: 80mm +/- 20

.2 If requested by Consultant, provide certification that plant, equipment, and all materials to be used in concrete comply with the requirements of CAN/CSA-A23.1.

.3 Use of calcium chloride not permitted.

2.3 ADMIXTURES

.1 Admixtures will be permitted only to correct deficiency in mixture or to make correct placement requirements as recommended by Testing Laboratory and approved by Consultant.

.2 Use of accelerating admixtures, if approved by Consultant, will not relax cold weather placement requirements of CAN/CSA-A23.1. Use of calcium chloride not permitted.

3 Execution

3.1 PREPARATION

.1 Obtain Consultant's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.
.2 Pumping of concrete will be permitted. Place concrete in accordance with CAN/CSA-A23.1 to meet all requirements of mix design at point of placement.
.3 Ensure reinforcement and inserts are not disturbed during concrete placement.
.4 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.
.5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
.6 In locations where new concrete is doweled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with shrinkage compensating grout or as noted on drawings to anchor and hold dowels in positions as indicated.
.7 Do not place load upon new concrete until authorized by Consultant.

3.2 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.
.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 Consultant.
  .2 Where approved by 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 Consultant.
  .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Consultant before placing of concrete.
  .4 Check locations and sizes of sleeves and openings shown on drawings.
  .5 Sleeve, do not core required openings.
.3 Placing Grout: Place shrinkage compensating grout under base plates for structural steel and other equipment, using procedures in accordance with manufacturer's recommendations, which result in 100%, contact over grouted area.
  .1 Refer to structural drawings for thickness and edge profile of grout under base plate for structural steel.
.4 Finishing.
  .1 Finish concrete to CAN/CSA-A23.1 with final finishing as follows:
    .1 Foundation walls: ensure that all form ties etc. are cut back to minimum 15mm below surface and depressions packed with cement mortar. Remove fins and other projections on exterior face to provide smooth surface for installation of membrane waterproofing, damp proofing, insulation or polyethylene slip sheet, as applicable at exterior and insulation on interior.
    .2 Refer to Section 03 35 00 for interior & exterior slab finish.
  .2 Rub exposed edges of concrete with Carborundum to produce 3mm radiused edges unless otherwise detailed.
.5 Waterstops.
  .1 Install waterstops to provide continuous water seal. Do not distort or pierce water stop in such a way as to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops. Tie waterstops rigidly in place.

.2 Use only straight heat sealed butt joints in field. Use factory welded corners and intersections unless otherwise approved by Consultant.

.6 Joint fillers.

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Consultant. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.2 Locate and form isolation joints as indicated. Install joint filler.

.3 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

.7 Under Slab Vapour Barrier.

.1 Install Under slab Vapour Barrier directly under concrete slabs-on-grade inside building.

.2 Lap membrane minimum 150 mm at joints and seal.

.3 Seal punctures in membrane before placing concrete. Use patching material at least 150 mm larger than puncture and seal.

.8 Polyethylene Slip Sheet/Bond Breaker

.1 Install 10mil polyethylene slip-sheet at exterior face of all foundation walls from top of footing to future finished grade. Provide temporary support until backfilling is completed.

.2 Use 10mil polyethylene sheet as bond breaker between foundation walls and slabs-on-grade and slabs on steel floor decking. Provide temporary support until slabs are placed. Trim flush with top of slab.

3.3 SITE TOLERANCE

.1 Concrete tolerance in accordance with CAN/CSA-A23.1 straight edge method.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
.2 Canadian Standards Association (CSA)
  .1 CSA A23.1:24/CSA A23.2:24, Concrete Materials and Methods of Concrete Construction.

1.3 PERFORMANCE REQUIREMENTS

.1 Product quality and quality of work in accordance with Division 01 - General Requirements.
.2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Division 01 - General Requirements.
.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Division 01 - General Requirements. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content.
.3 Include application instructions for concrete floor treatments.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Work area:
  .1 Make the work area water tight protected against rain and detrimental weather conditions.
.2 Temperature:
  .1 Maintain ambient temperature of not less than 10°C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 80% during same period.
.3 Moisture:
  .1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
.4 Safety:
  .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
.5 Ventilation:
  .1 Contractor will arrange for ventilation system to be operated during installation of concrete floor treatment materials.
  .2 Ventilate enclosed spaces in accordance with Division 01 - General Requirements.
  .3 Provide continuous ventilation during and after coating application.

1.6 QUALITY CONTROL

.1 Pre-Pour Meeting
  .1 Attend a pre-pour quality control meeting including all relevant sub-trades to review the quality of exposed concrete finishes, hardener/sealer application, saw cuts, prepared sub-base, under floor services, pour sequence and related issues.
  .2 Prior to pouring concrete, provide a 750mm high x 450mm x 450mm sample complete with chamfered corners for the purpose of establishing finish quality of exposed concrete columns, walls and ceilings.

.3 The quality of the finished concrete is to be equal or better than the accepted sample.
.4 Where the quality of finished concrete falls short of accepted sample for exposed concrete, the Contractor must pay all associated costs to achieve quality of exposed concrete as provided by approved sample.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.
.4 Place materials defined as hazardous or toxic waste in designated containers.
.5 Ensure emptied containers are sealed and stored safely for disposal.
.6 Use chemical hardeners that are non-toxic.
.7 Dispose of surplus chemical and finishing materials in accordance with federal, provincial and municipal regulations.
.8 Dispose of waste from stripping of floors in a manner that will not have unfavorable effects on the environment.

2 Products

2.1 CHEMICAL HARDENERS

.1 Type 1 - Sodium silicate.
.2 Water: potable.

2.2 SEALING COMPOUNDS

.1 Surface sealer: to CAN/CGSB-25.20, Type 1 - solvent-based, clear.
.2 Surface sealers may not be manufactured or formulated with aromatic solvents hexavalent chromium and their compounds.

2.3 CURING AND SEALING COMPOUNDS

.1 Curing for plain interior floor slabs: all new interior floors at ground floor level shall be moist cured in accordance with the requirements of CAN/CSA A23.1-00, Par, 21.1.6.1 (a) and/or (b). The use of proprietary curing and sealing compounds not permitted.
  .1 Moist cure shall not be achieved with flooding which may cause damage to existing adjacent occupied areas.
.2 Curing and sealing compound for floor slab and housekeeping pad: liquid type, water-based acrylic to ASTM C-309.
  .1 Acceptable Material:
    .1 Meadows "Vocomp 20".
    .2 CPD Acrylic Cure and Seal (Water Based).
    .3 Sternson Florseal WB.
    .4 Master Builders "Master-Kure-100W".
    .5 Pecora DynaTrol II SG.
.3 Cementitious Saw-Cut Control Joint Filler:
  .1 One-component, non-shrink, fast-setting and drying, polymer-modified cementitious mortar, compatible with adhesive for resilient sheet flooring.
  .2 Acceptable Material:
    .1 MAPEI Planipatch.
    .2 Master Builders EMACO R-300.
.4 Flexible Saw-Cut Control Joint Filler:
  .1 Two component, non-priming, self-leveling, chemical curing polyurethane sealant.
  .2 Acceptable Material:
    .1 Tremco "THC-900".

.2 Sonneborn "SL-2".
.3 Pecora NR 200.

.5 Use compatible additives, admixtures, curing compounds and hardeners.
.6 Do not sprinkle dry cement or dry cement and sand mixture over concrete surfaces.

2.4 MIXES

.1 Mixing, ratios and application in accordance with manufacturer's instructions.

3 Execution

3.1 EXAMINATION

.1 Verify that slab surfaces are ready to receive work and elevations are as indicated on shop drawings.

3.2 PREPARATION OF EXISTING SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.
.2 Saw cut control joints to CSA-A23.1, 24 hours maximum after placing of concrete. Saw cuts not cut straight will be rejected and concrete replaced.
.3 Use strong solvent to remove chlorinated rubber or existing surface coatings.
.4 Use protective clothing during stripping of chlorinated rubber or existing surface coatings.

3.3 APPLICATION

.1 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with Joint Filler.
.2 Apply floor treatment in accordance with Sealer manufacturer's written instructions.
.3 Clean over spray. Clean sealant from adjacent surfaces.
.4 Co-ordinate curing and sealing compounds with floor finishes.

3.4 CONCRETE FINISHES

.1 Finish concrete in accordance with CAN3-A23.1.
  .1 Interior floor slabs: Hard, smooth dense, troweled to flat tolerance classification (5mm in 3m).
  .2 Finishes:
    .1 Exposed concrete is to be smooth, even, joints are to be rubbed to remove joint edges and free from excess air pockets. All as evaluated against the submitted sample.
.2 Do not sprinkle dry cement or dry cement and sand mixture over concrete surfaces.
.3 Saw cut crack control joints to CAN3-A23.1, to match existing locations and to layouts indicated on drawings.

3.5 APPLICATION OF CURING AND SEALING COMPOUNDS

.1 Apply in strict accordance with manufacturer's instructions and at rate recommended by manufacturer to meet moisture-retention requirements of ASTM C309.
.2 Apply to concrete floor slab using appropriate type as specified under PART 2 of this section. Use ONLY curing and sealing compound by same manufacturer as manufacturer of hardener, and recommended by manufacturer as compatible with hardener.
  .1 Where applicable apply curing and sealing compound following application of hardener at time recommended by manufacturer.
  .2 Coordinate with finish schedule for applied flooring.

3.6 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

3.7 FILLING OF SAW-CUT CONTROL JOINTS

.1 Clean and prepare saw-cut control joints at interior floor slabs to joint filler manufacturer's requirements.

.2 Install self-leveling sealant at the bottom of all saw-cut control joints in the concrete floor slabs.

.3 Install cementitious joint filler over flexible sealant in all joints. Strike filler flush with surface of concrete slab and leave ready for installation of floor finish.

3.8 APPLICATION OF EXTERIOR SEALING COMPOUNDS

.1 After concrete has cured for thirty (30) days apply sealing compound to all exterior concrete walks, in accordance with manufacturer's recommendations.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast in Place Concrete.
.2 Section 03 35 00 - Concrete Finishing.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA A23.1:24/CSA A23.2:24, Concrete Materials and Methods of Concrete Construction.

1.3 PERFORMANCE REQUIREMENTS

.1 Product quality and quality of work in accordance with Division 01 - General Requirements.
.2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Division 01 - General Requirements.
.2 Submit WHMIS MSDS Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content.
.3 Include application instructions for concrete floor treatment(s).

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Temporary lighting:
  .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
.2 Electrical power:
  .1 Sufficient electrical power to operate equipment normally used during construction, will be provided.
.3 Work area:
  .1 Clean the work area necessary to install the products specified in this section.
.4 Temperature:
  .1 Maintain ambient temperature of not less than 10 EC 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.
.5 Moisture:
  .1 Ensure concrete substrate is within moisture limits prescribed by materials manufacturer.
.6 Safety:
  .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
.7 Ventilation:
  .1 Contractor to coordinate and provide temporary ventilation system to be operated during installation of concrete floor treatment materials
  .2 Provide continuous ventilation during and after coating application. Building ventilation not to be used.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.

.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.
.4 Place materials defined as hazardous or toxic waste in designated containers.
.5 Ensure emptied containers are sealed and stored safely for disposal away from children.
.6 Chemical used in products should be non toxic and have zero or low VOC's.
.7 Dispose of surplus chemical and finishing materials in accordance with federal, provincial and municipal regulations.

2 Products

2.1 EPOXY BONDING AGENT AND PRIMER - PART A

.1 Epoxy bonding agent and primer is a two-component, multipurpose epoxy bonding agent and primer, non-shrinking, 100%-solids and moisture-insensitive. Product to meet ASTM C881 requirements.

Physical Characteristics:

Calculated VOC (see below)	0 g/L
Boiling Point	N/A
Vapour Pressure (mm Hg)	N/A
Specific Gravity (H2O=1)	1.17
Melting / Freezing Point (F)	N/A
Evaporation Rate (Butyl Acetate=1)	N/A
Solubility in Water	Negligble
pH (paste / liquid)	N/A
Appearance and Odor	White Liquid / Epoxy

.2 Acceptable Material:
.1 "Mapei" - Planibond EBA Part A or similar materials manufactured by "Sika".

2.2 EPOXY BONDING AGENT AND PRIMER - PART B

.1 Epoxy bonding agent and primer is a two-component, multipurpose epoxy bonding agent and primer, non-shrinking, 100%-solids and moisture-insensitive. Product to meet ASTM C881 requirements.

Physical Characteristics:

Calculated VOC (see below)0 g/L	0 g/L
Boiling Point	N/A
Vapour Pressure (mm Hg)	N/A
Vapour Density (AIR=1)	N/A
Specific Gravity (H2O=1)	1.68
Melting / Freezing Point (F)	N/A
Evaporation Rate (Butyl Acetate=1)	N/A
Solubility in Water	Negligible
pH (paste / liquid)	N/A
Appearance and Odor	Gray Paste / Arine Odor

.2 Acceptable Material:
.1 "Mapei" - Planibond EBA Part B or similar materials manufactured by "Sika".

2.3 SELF LEVELING TOPPING

.1 Self leveling topping product to be a high-hydrated cement technology-based, self-leveling, self-drying topping that is specially formulated for the resurfacing and construction of interior horizontal surfaces.

BEFORE MIXING:

Physical State	Powder
Colors & Shelf Life	Light gray, white 6 months in original bag, in dry heated covered place
Flammability	Flame Spread: 0 Fuel Contribution: 0 Smoke Development: 0
Health & Safety	Consult the Material Safety Data Sheet (MSDS) for safe-handling instructions.

MIXED

Mixing Ratio	Water: Ultratop (powder) 4.75 to 4 U.S. qts: 50-lb bag (4.50 5o 4.73 L: 22.7-kg bag)
Density	128 lbs/cu.ft. (2.06 kg/L)
pH	11
Application Temp. Range	50°F to 90°F (10°C to 35°C)
Pot Life 73°F (23°C)	20 to 30 minutes
Flowing time at 73°F (23°C)	15 minutes
Time required before installation floor covering or coating	Typically 24 hours depending on temperature and humidity
Compressive strength - ASTM C109 (CAN/CSA-A5)	1 day >2,500 psi (17.2 MPa) 7 days >4.400 psi (30.3 MPa) 28 days >6,100 psi (42.1 MPa)
Flexural strength - ASTM C348 (CAN/CSA - A23.2-8C)	1 day >650 psi (4.48 MPa) 7 days >1,280 psi (8.83 MPa) 28 days >1,400 psi (9.66 MPa)
Pull-out strength (rupture of concrete) (CAN/CSA-A23.2-6B)	3 days >260 psi (1.79 MPa) 7 days >300 psi (2.07 MPa) 28 days >350 psi (2.41 MPa)
Abrasion resistance (ASTM D4060/ Taber H22-500 g, 200 cycles)	After 28 days 0.17 grams of loss
Volume change (ASTM C157)	0.07% (28 days) (dry-cure)

.2 Acceptable Material:
.1 "Mapei" Ultra to P or Sika floor level 25 CA and/or 50 CA.

2.4 CURING COMPOUNDS

.1 Select low VOC, curing compounds.

2.5 MIXES

.1 Mixing, ratios and application in accordance with manufacturer's instructions.

2.6 MANUFACTURER

.1 All products are to be from a single manufacturer.

3 Execution

3.1 EXAMINATION

.1 Verify that slab surfaces are ready to receive work.

3.2 PREPARATION OF EXISTING SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges.
.2 Use protective clothing, eye protection, and respiratory equipment during topping installation.

3.3 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

3.4 APPLICATION - EPOXY BONDING AGENT AND PRIMER

.1 Surface Preparation:
  .1 All approved subfloors must be structurally sound, stable, and solid.
  .2 Thoroughly clean the surface of any substance that could interfere with the bond of the installation material, including dirt, paint, tar, asphalt, wax, oil, grease, latex compounds, sealers, curing compounds, form release agents, laitance, loose toppings, foreign substances and adhesive residue.
  .3 Mechanically clean and prepare by shot blasting, scarifying, or other engineer-approved methods. Remove all dust, debris and other contaminants prior to application.
  .4 Concrete and masonry substrates must be at least 28 days old. Substrate hydrostatic pressure conditions and vapour transmission must not exceed 1,36 kg per 92,9 m2 per 24 hours. Use a calcium chloride test (reference ASTM F1869) prior to application.
  .5 Concrete substrate and ambient room temperature must be between 10°C and 35°C prior to application.
  .6 Temperatures must be maintained within this range for a minimum of 72 hours after the installation of Planibond EBA and finished material.
  .7 Moisture vapour transmission exceeding 1,36 kg per 92,9 m² per 24 hours must first be treated by installing a suitable moisture-reduction barrier.
  .8 Apply a small test area to ensure compatibility with the moisture-reduction barrier before general installation. Once the barrier is cured, apply a single coat of Primer for underlayments and for concrete, screed mortars or repair mortars.
  .9 Apply at a thickness of 20 mils (0.5 mm).
.2 Mixing:
  .1 Store components at room temperature before mixing.
  .2 Using a "Jiffy" mixing paddle, stir individual components separately before combining.
  .3 Using a low-speed mixer (at about 300 to 550 rpm) and a "Jiffy" mixing paddle, mix Part A with Part B together thoroughly for 3 minutes until achieving a uniformly mixed material. Stop after about a minute to scrape excess off sides of the mixing container. Mix to a smooth, homogeneous consistency. Do not mix at high speeds, which can trap air within the mixed material. Always ensure that well-mixed equal amounts of Part A are combined with the same of Part B.
  .4 Only mix as much material as can be applied within the pot life (about 30 minutes). Warm temperatures and/or mixing a large volume of material at a time can greatly reduce the pot life of epoxies.
.3 Application:

.1 Make sure the concrete substrate and ambient room temperatures are between 10 °C and 35 °C prior to application. Temperatures must be maintained within this range for a minimum of 72 hours after the installation of primer and finished material. In cooler conditions, use indirect auxiliary heaters to maintain ambient and substrate temperatures within the required range. To ensure a successful installation for temperatures above 29 °C, consider ACI 305R-99 hot-weather concreting guidelines and take appropriate precautions to keep the material cool and to keep it out of direct sunlight and significant air movement.

.4 Application as a bonding agent and primer. For ease of application, apply on a substrate with a CSP of 1 to 4.
- .1 Pour mixed primer onto the floor.
- .2 Apply the primer onto the substrate with a brush, roller, broom or trowel, working material into the profiled substrate. Completely cover all areas of substrate that will receive the concrete, underlayment topping, screed mortar or repair mortar.
- .3 Apply at a thickness of 20 mils (0.5 mm).
- .4 Concrete, toppings, must be placed onto the Planibond EBA while it is tacky to ensure a successful installation.

.5 Cleaning:
- .1 Clean tools and protective gear with mineral spirits. Cured material can only be mechanically removed.

3.5 APPLICATION - HIGH PERFORMANCE, QUICK SETTING, SELF LEVELING CONCRETE TOPPING

.1 Surface Preparation:
- .1 All substrates must be structurally sound, stable and solid.
- .2 Thoroughly clean the surface of any substance that could interfere with the bond of the installation material, including dirt, paint, tar, asphalt, wax, oil, grease, latex compounds, sealers, curing compounds, form release agents, laitance, loose toppings, foreign substances and adhesive residue.
- .3 Concrete surfaces must be mechanically profiled and prepared by shot blasting, sandblasting, water-jetting, scarifying, diamond-grinding or other engineer-approved methods (reference ICRI CSP 5 standards acceptable profile height).
- .4 Substrate hydrostatic pressure conditions and vapour transmission must not exceed 1,36 kg per 92,9 m² per 24 hours. Use a calcium chloride test (reference ASTM F1869) before application.
- .5 Concrete substrate and ambient room temperatures must be at least 10 °C and not exceed 35 °C prior to application.
- .6 Temperatures must be maintained within this range for at least 72 hours after the installation of Ultratop.
- .7 Fill deep areas, holes or cracks with appropriate concrete restoration materials, especially when installing on a floor on the second story or higher where fluid could leak to a floor below.
- .8 Always prime the prepared surface with a primer before the application of topping.
- .9 Do not apply primer over standing water.
- .10 Allow Primer L or Primer WE to dry completely to a semitransparent film, with no milky-wet spots, before the installation of Ultratop.
- .11 Some mechanically prepared substrates may be more porous than others. For porous concrete, "double-prime" the surface with latex primer. Dilute the first coat: 1 part Primer to 3 parts potable water; dilute the second coat: 1 part Primer to 1 part potable water. Additional coats may be required over extremely porous concrete (reference the Technical Data Sheet for details). Porous concrete also can be subject to "outgassing," the release of trapped air from concrete. Outgassing is visually undetectable and could cause problems with the installation. Wait 48 hours after the substrate has been properly prepared, before applying the first coat of primer.

.12 Outgassing, as a result of a moisture vapour transmission exceeding 1,36 kg per 92,9 m² per 24 hours, must first be treated by installing a suitable moisture-reduction barrier. Apply a small test area to ensure compatibility with the moisture-reduction barrier before general installation. Once the barrier is cured, apply a single coat of Primer before the application of topping.

.13 To install over properly prepared ceramic tile, vinyl asbestos tile, vinyl composition tile, cement and epoxy terrazzo, and thin layers of old cutback adhesive residue, the surface must be properly prepared, bonded, free from dirt and dust, and primed. Prime by applying a thin coat of Primer.

.2 Mixing:

.1 General Mixing:

.1 Using a clean mixing container, pour in the required amount of cool, clean potable water, If available water is not cool, chill water to 21 °C. Add Ultratop powder while slowly stirring. Mix water and Ultratop powder to a mixing ratio of 4,50 to 4,73 L of water per 22,7-kg bag of Ultratop. The mixing ratio must remain consistent, especially when integral color materials are involved. Do not over water material.

.2 For best results, use a Self-Leveling Tool Kit (contact manufacturer).

.2 Barrel Mixing:

.1 Using the appropriate mixing ratio above, mix using a low-speed mixer (about 1, 200 rpm) with an "Egg-Beater" mixing paddle. Mix to a homogeneous, lump free consistency, for about 3 minutes. Do not over mix. Over mixing or moving the mixer up and down during the mixing process could cause air entrapment, which could shorten the pot life or cause pin holing during the application and curing.

.3 Pump Mixing:

.1 Topping can be mechanically mixed, using the appropriate mixing ratio above, with a Continuous Mixer and Pump (with at least 42,7 m of hose) or a Batch Mixer and Pump (with at least 33,5 m of hose). Mixer and pump must be in good working condition. Periodic cleaning of pumping equipment is required per the manufacturer's instructions. Be sure to pressure-test rotor and stator for proper mixing. Use a mesh screen "sock" at the end of the hose to catch any foreign material that could enter the hopper of the mixer Apply a small test area before general application to ensure a successful installation.

.3 Application:

.1 Before installation, close all doors and windows to prevent drafts. Protect areas from direct sunlight.

.2 Make sure concrete substrate and ambient room temperature are at least 10 °C and below 35 °C before application. Temperatures must be maintained within this range for at least 72 hours after the installation of Ultratop. In cooler conditions, use indirect auxiliary heaters to maintain ambient and substrate temperatures within the required range. For temperatures above 29 °C, follow ACI hot-weather application guidelines to ensure a successful installation.

.3 Application of topping over large areas can be made easier and more efficient by using conventional piston, rotor-stator or underlayment-type pumps.

.4 For best results, work as a team to provide a continuous flow of wet material to avoid trapping air or creating a cold joint.

.5 Set the width of the pour at a distance that is ideal for maintaining a wet edge throughout placement. Quickly pour topping or pump onto the properly prepared and primed surface in a ribbon pattern. If a wet edge cannot be maintained, reduce the width of the pour.

.6 Topping has an approximate flow time of 15 minutes at 23°C, is self-leveling and can be applied from 6mm up to 50mm in a single application. Note that temperature and

humidity will affect working time, flow ability and setting time. Apply enough material to adequately cover all high spots.

.7 Immediately after placing the topping, spread the material with a Gauge Rake. After achieving the desired depth, smooth with a smoother to obtain an even surface. To avoid air entrapment, do not overwork the material.

.8 For extended installations from 50 to 125mm, contact Technical Services Department.

.9 Topping quickly hardens within 2 to 3 hours and is ready to accept stains, sealers or coatings in as little as 24 hours. Sealers and coatings protect surfaces from contaminants and optimize surface integrity.

.4 Curing

.1 Ultratop is self-curing; do not use a damp-curing method, or curing and sealing compounds.

.2 Protect Ultratop from excessive heat or draft conditions during curing. Turn off all forced ventilation and radiant-heating systems. Protect for up to 24 hours after completion.

.3 Avoid walking on the installed surface for at least 2 to 3 hours after installation, depending upon temperature and humidity conditions.

.4 Protect from traffic, dirt and dust from other trades until the final floor sealer or coating has been installed and completely cured. When using to repair a concrete surface, do not leave surface exposed. Cover with a final wear surface.

.5 Do not expose topping to rolling dynamic loads, such as forklifts or scissor lifts, for at least 48 hours after installation.

.6 Topping can be stained, sealed or coated 24 hours after application. Topping moisture content must not exceed 1,36 kg per 92,9 m² per 24 hours using a calcium chloride test (reference ASTM F1869), before the application of a stain, sealer, coating or floor covering. Follow the stain, sealer or coating manufacturer's recommendations. Test all surface treatments on a small sample area, before application, to ensure the desired results.

.5 Cleaning:

.1 Wash hands and tools with water promptly before material hardens. Cured material must be mechanically removed.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 31 00 - Steel Decking.
.2 Section 09 91 00 - Painting.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB 1.40-97, Anti corrosive Structural Steel Alkyd Primer.
  .2 CAN/CGSB 1.105-M91, Quick Drying Primer.
  .3 CAN/CGSB 85.10-99, Protective Coatings for Metals.
  .4 CAN/CGSB 85.100-93, Painting.
  .5 CGSB 85 GP-14M-78, Painting Steel Surfaces Exposed to Normally Dry Weather.
.2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
  .1 CISC/CPMA 2-75, Quick-Drying, Primer for Use on Structural Steel.
  .2 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.
.3 Canadian Standards Association (CSA International)
  .1 CSA G40.20-13 (R2018)/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  .2 CSA S16:19, Design of Steel Structures.
  .3 CSA S136 (R2021) - North American Specification for the Design of Cold Formed Steel Structural Members (Using Appendix B provisions applicable to Canada).
  .4 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
  .5 CSA W55.3-08 (R2018), Certification of Companies for Resistance Welding of Steel and aluminum.
  .6 CSA W59-18 (R2023), Welded Steel Construction (Metal Arc Welding).

1.3 QUALITY ASSURANCE

.1 At least 4 weeks prior to fabrication of steel joists, submit 8 copies of mill test reports at least 4 weeks prior to fabrication of steel joists and accessories. Reports to show:
  .1 Chemical and physical properties.
  .2 Other details of steel to be incorporated into work.
  .3 Certification by qualified metallurgists confirming that tests conform to requirements of CSA G40.20/G40.21
.2 Supply affidavit prepared by fabricator of structural steel joists stating that materials and products used in fabrication conform to this specification.
.3 All steel joists used on this project to be fabricated in Canada from steel manufactured in Canada by Canadian Mills.

1.4 DESIGN OF STEEL JOISTS AND BRIDGING

.1 Design steel joists and bridging to carry loads indicated on drawings in accordance with CAN/CSA-S16.1.
.2 Deflection under live load, as applicable, shall not exceed
  .1 1/240th of span for roof joists
  .2 1/360th of span for floor joists
  .3 Camber for dead load with deflection as noted above for live load is acceptable.
.3 Design floor joists over (9000 mm) 30 feet span for a minimum frequency of 8HZ.
.4 Submit 3 copies for calculations and joist design drawings for typical joists for Consultant to review at least 4 weeks prior to fabrication and/or delivery.

1.5 SHOP DRAWINGS

.1 Submit shop details and erection drawings in accordance with Division 01 - General Requirements.
.2 Each shop drawing submitted shall bear stamp and signature of qualified professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.
.3 Indicate on erection drawings, relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and details.
.4 Provide particulars, on shop drawings, relative to joist geometry, framed openings, splicing details, bearing and anchorage. Include member size, properties, specified and factored member loads, and stresses under various loadings, deflection and camber.
.5 Reproduction of contract drawings for use as shop/erection drawings is permitted only with Consultant's approval.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.
.4 Divert unused metal materials from landfill to metal recycling facility.
.5 Dispose of unused paint material at official hazardous material collections site.

2 Products

2.1 MATERIALS

.1 Structural steel: to CSA-G40.20/G40.21.
.2 Welding materials: to CSA-W59 with CSA-W59S1.
.3 Shop paint primer: to CAN/CGSB-1.40.

2.2 FABRICATION

.1 Fabricate steel joists and accessories as indicated in accordance with CAN/CSA-S16.1 and in accordance with reviewed shop drawings
.2 Weld in accordance with CSA-W59 and with CSA-W59S1.
.3 Provide top chord extensions where required.
.4 Provide diagonal and horizontal bridging and anchorages as indicated and in accordance with CAN/CSA-16.1

2.3 SHOP PAINTING

.1 Clean, prepare and shop prime surfaces of steel joists to CAN/CSA-S16.
.2 Clean members of loose mill scale, rust, oil, dirt and other foreign matter. Prepare surfaces in accordance with SSPC SP1 brush blast.
.3 Apply one coat of CISC/CPMA 2 primer to steel surfaces to achieve maximum dry film thickness of .065 mm to .080 mm except:
    .1 Surfaces to be encased in concrete.
    .2 Surfaces to receive field installed stud shear connectors and steel decks.
    .3 Surfaces and edges to be field welded.
    .4 Faying surfaces of friction-type connections.
.4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 deg C.
.5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
.6 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

3 Execution

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S16.
.2 Welding: in accordance with CSA-W59 and with CSA-W59S1.
.3 Companies to be certified under Division 1 or 2.1 of CSA-W47.1 for fusion welding and/or CSA-W55.3 for resistance welding.
.4 Provide certification that welded joints are qualified by Canadian Welding Bureau.
.5 Steel fabrication companies to be Canadian Institute of Steel Construction (CISC) certified.

3.2 CONNECTION TO EXISTING WORK

.1 If and where applicable verify dimensions and condition of existing work; report discrepancies and potential problem areas to Consultant for direction before commencing fabrication.
.2 The work of this Section also includes the re-working and reinforcing of steel joists at new openings in existing floor slabs, as detailed and at locations shown on the structural drawings.

3.3 FIELD QUALITY CONTROL

.1 On-site inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Owner and paid by Owner.
.2 Testing laboratory will inspect representative joists for integrity, accuracy of fabrication and soundness of welds. Testing laboratory will also monitor test loading of joists used by manufacturer to verify design and check representative field connections. Consultant will determine extent of and identify all inspections.

3.4 ERECTION

.1 Erect steel joists and bridging as indicated in accordance with CAN/CSA-S16.
.2 Complete installation of all bridging and anchorages before placing construction loads on joists.
.3 Field cutting or altering joists or bridging that are not shown on shop drawings: to approval of Consultant.
.4 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

3.5 FIELD PAINTING

.1 Paint: in accordance with Section 09 91 00 - Painting.
.2 Touch up all damaged surfaces and surfaces without shop coat with CISC/CPMA-1 in accordance with manufacturers' recommendations to CAN/CGSB-85.10.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 21 00 - Steel Joist Framing.
.2 Section 05 51 00 - Metal Stairs.
.3 Section 09 91 00 - Painting.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
  .1 ASTM A653/A653M-09a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  .2 ASTM A792/A792M-09a, Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
.3 Canadian Standards Association (CSA International)
  .1 CSA C22.2 No.79-1978(R2008), Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
  .2 CSA S16:19, Design of Steel Structures.
  .3 CSA S136-94(R2001), Cold Formed Steel Structural Members.
  .4 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
  .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).
.4 Canadian Sheet Steel Building Institute (CSSBI)
  .1 CSSBI 10M-08, Standard for Steel Roof Deck.
  .2 CSSBI 12M-08, Standard for Composite Steel Deck.

1.3 DESIGN REQUIREMENTS

.1 Design steel deck using working stress design, in accordance with CSSB1 10M and CSSB1 12M as applicable.
.2 Steel deck and connections to steel framing to carry dead, live and other loads including lateral loads, diaphragm action, composite deck action, and uplift as indicated.
.3 Deflection under specified live load not to exceed 1/240 of span, except that when plaster ceilings are hung directly from deck, live load deflection not to exceed 1/360 of span.
.4 Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CAN/CSA-S16.1, Appendix 'G'.
.5 All steel decking used on this project to be fabricated in Canada, from steel manufactured in Canada by Canadian Mills.

1.4 SHOP DRAWINGS

.1 Submit shop drawings erection and shoring drawings in accordance with Division 01 - General Requirements.
.2 Each shop drawing submitted shall bear stamp and signature of qualified professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.
.3 Submit design calculations if requested by Consultant.
.4 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.
.5 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete fill decks.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.
.4 Divert unused metal from landfill to metal recycling facility.
.5 Dispose of unused paint material at official hazardous material collections site.
.6 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
.7 Dispose of unused caulking material at official hazardous material collections site.

2 Products

2.1 MATERIALS

.1 Closures: as approved in accordance with manufacturer's recommendations.
.2 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm. Metallic coating same as deck material.
.3 Primer: zinc rich, ready mix to CAN/CGSB-1.181.
.4 Hilti steel deck fasteners purpose designed for the application or 20mm diameter puddle welds complete with washers.
.5 #10 Tek screws or side lap button punching.

2.2 TYPES OF DECKING

.1 Roof deck: single fluted element, with nominal base steel thickness of 0.76 mm (22 ga.) and/or 0.912 mm (20 ga.) with interlocking side laps.
    .1 Acceptable Material:
        .1 Canam P-3615.
        .2 Canadian Metal Rolling Mills S-15.

3 Execution

3.1 GENERAL

.1 Structural steel work: in accordance with CAN/CSA-S136 and CSSB1 10M and CSSB1 12M as applicable.
.2 Welding: in accordance with CSA W59 and with CSA W59S1, except where specified otherwise.
.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.
.4 Steel fabrication companies to be Canadian Institute of Steel Construction (CISC) certified.

3.2 ERECTION

.1 Erect steel deck as indicated and in accordance with CSA S136 and CSSB1-10M and CCSB1-12M as applicable and manufacturer's instructions and in accordance with approved erection drawings.
.2 Fastening uplift resistance to CSA S136.F04, 2.09kN.
.3 Weld decking to steel joists and steel beams strictly in accordance with requirements indicated on drawings.
.4 Where underside of steel decking will be exposed in the final assembly. Exercise care during handling and installation to ensure that exposed face will be free from dents, scratches, excessive weld burns and other unsightly blemishes. Use chalk line to locate joists. Hammer marks or dents alongside of top chords not acceptable.
.5 Butt ends: to 1.5 to 3 mm gap. Install steel cover plates over gaps wider than 3 mm.

.6 Lap ends: to 50 mm minimum.
.7 Weld and test stud shear connectors through steel deck to steel joists/beams below in accordance with CSA W59.
.8 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.
.9 Prior to concrete placement, steel deck to be free of soil, debris, standing water, loose mil scale and other foreign matter.
.10 Temporary shoring, if required, to be designed to support construction loads, wet concrete and other construction equipment. Do not remove temporary shoring until concrete attains 75% of its specified 28 day compression strength.
.11 Place and support reinforcing steel as indicated.
.12 Deck to span minimum of 3 joist spans generally.

3.3 CLOSURES

.1 Install closures in accordance with approved details. Refer to 2.1.2.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

.1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.
.2 Frame deck openings with any one dimension between 150 to 300 mm as recommended by manufacturer, except as otherwise indicated.
.3 For deck openings with any one dimension greater than 300 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 CONNECTIONS

.1 Install connections in accordance with CSSBI Steel Roof Deck, 10M-86 and Composite Steel Deck. 12M-84 as applicable and in accordance with design requirements for diaphragm action.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Following description of work is included for reference only and shall not be presumed to be complete:
- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 05 21 00 - Steel Joist Framing.
- .3 Section 05 31 00 - Steel Deck.
- .4 Section 05 51 00 - Metal Stairs.
- .5 Section 09 91 00 - Painting.
- .6 Division 10 - Specialties.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM A53/A53M-07, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A269-10, 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.
- .4 ASTM A123/A123M-09, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .5 ASTM A153/A153M-09, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- .6 ASTM A325M-07a, Specification for High-Strength Bolts for Structural Steel joints.
- .7 ASTM A653M-09a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .8 ASTM B117-09, Practice for Operating Salt Spray (Fog) Apparatus.
- .9 ASTM E119-09c, Test Methods for Fire Tests of Building Construction and Materials.
- .10 ASTM E736-00 (2006), Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
- .11 ASTM F436M-10, Specification for Hardened Steel Washers.
- .12 ASTM F738M-02 (2008), Specification for Stainless Steel Metric Bolts, Screws, and Studs.
- .13 ASTM F836M-02, Specification for Style 1 Stainless Steel Metric Nuts.
- .14 ASTM F844-07a, Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB 1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
- .2 CAN/CGSB 1.181-99, Ready Mixed Organic Zinc-Rich Coating
- .3 CAN/CGSB 85.10-99, Protective Coatings for Metals

.3 Canadian Standards Association (CSA International)
- .1 CAN/CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CAN/CSA G164-18 (2023), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA S16:19, Design of Steel Structures.
- .4 CSA W48:23, Filler Metals and Allied Materials for Metal Arc Welding.
- .5 CSA W59-18 (R2023), Welded Steel Construction (Metal Arc Welding).
- .6 CSA S136 (R2021) - North American Specification for the Design of Cold Formed Steel Structural Members (Using Appendix B provisions applicable to Canada).
- .7 CSA W47.1:19 - Certification of Companies for Fusion Welding of Steel.
- .8 CSA W47.2-11 (R2020) - Certification of Companies for Fusion Welding of Aluminum.

.9 CSA W48.1 (R2006) - Carbon Steel Covered Electrodes for Shielded Metal Arc Welding.
.10 CSA W117.2:19 (R2023) - Safety in Welding, Cutting, and Allied Processes.
.11 SSPC - Steel Structures Painting Council, "Steel Structures Painting Manual, Vol. 2".

1.3 SUBMITTALS FOR REVIEW

.1 Refer to Division 01 - General Requirements.
.2 Shop Drawings:
.1 Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
.2 Indicate welded connections using standard welding symbols. Indicate net weld lengths.
.3 Each shop drawing submitted shall bear stamp and signature of qualified professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.

1.4 SUBMITTALS FOR INFORMATION

.1 Refer to Division 01 - General Requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Refer to Division 01 - General Requirements.

1.6 QUALITY ASSURANCE

.1 Welders' Certificates: Submit to Division 01 - General Requirements, certifying welders employed on the Work, verifying qualification within the previous twelve (12) months to CSA-W47.1 (steel) CSA-W47.2 (aluminum) CSA-W55.3.
.2 elded Steel Construction: CSA-W59.
.3 Welded Aluminum Construction: CSA-W59.2.
.4 Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Coordinate deliveries to comply with construction schedule and arrange ahead for strategic off-the-ground, undercover storage locations. Do not load areas beyond the designed limits.
.2 Handle and store metal materials at job site in such a manner to prevent damage to other materials, (to existing buildings) or property.
.3 Handle components with care, and Provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces. Use lifting chokers of material which will not damage surface of steel members.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MATERIALS

.1 Steel sections and plates: New Material Conforming to CAN/CSA-G40.20/G40.21, Grade 300W.

.2 Hollow Structural Sections: New material conforming to CSA G40.20 and CSA G40.21, Grade 350W, Class H.

.3 Steel Pipe: ASTM A53, Type E or S, Grade A or B, Standard weight, Schedule 40.

.4 Stainless Steel:

.1 Provide highest architectural quality in various forms, straight and true. Ensure there are no scratches, scars, creases, buckles, ripples or chatter marks. Provide finished surfaces suitable for polishing where required. Ensure finished surfaces exposed to view are free of pitting, seam marks, roller marks, oil-canning, stains, discolorations or other imperfections.

.2 Stainless Steel Sheet, Strip, Plate, and Flat Bar: ASTM A167 or ASTM A666, Type 304 and Type 316 alloy with exposed surfaces having No. 4 polished finish. Sizes as required to meet design requirements.

.3 Stainless Steel Tubing: ASTM A554, Grade MT 304.

.4 Stainless Steel Exterior Tubing: ASTM A554, Grade MT 316.

.5 Stainless Steel Pipe: ASTM A312M, Grade TP 304.

.6 Stainless Steel Exterior Pipe: ASTM A312M, Grade TP 316.

.7 Castings: ASTM A743M, Grade CF 8 or Grade CF 20. Type 304.

.8 Castings: ASTM A743M, Grade CF 8M. Type 316.

.5 Welding Materials: Conforming to CSA W48.1-M and CSA W59-M.

.6 Common or Ordinary Bolts and Anchor Bolts: Unfinished bolts conforming with ASTM A307, Grade A, with hexagon heads and nuts where exposed in the finish work. Supply common bolts of lengths required to suit thickness of material being joined, but not projecting more than 6 mm beyond nut, without the use of washers. Supply anchor bolts of lengths noted, but projecting not less than 13 mm beyond nut unless otherwise noted.

.7 Galvanized Primer Paint: Zinc rich conforming to CAN/CGSB-1.181 for new galvanized metal.

.8 High Performance Corrosion Protection for Perimeter Steel: 1 component, moisture cured, micaceous iron oxide/zinc filled primer, UL Classified in accordance with UL 263 (ASTM E119), corrosion protection in accordance with ASTM B117, meeting Class B Slip Certification in accordance with American Institute of Steel Construction (AISC) requirements for slip critical bolted connections, tested in accordance with ASTM E736 for its suitability for application of primer over steel to receive sprayed fireproofing "Series394, Perime Prime" by Tnemec Company Incorporated; www.tnemec.com.

.9 Steel Pipe Handrails: Conforming to ASTM A53M, Type "S", Schedule 40, Grade A steel pipe of sizes down.

.10 Steel Pipe Bollards: Conforming to ASTM A53M, Schedule 80 steel pipe of sizes shown.

.11 Galvanized: Hot dipped galvanized with minimum zinc coating of 600 g/m2 to CAN/CSA-G164-M.

.12 Galvanized Sheet Steel: Supply 0.91 mm (20 ga) core thickness commercial quality to ASTM A653M, CS Type A, with Z275 zinc coating designation to ASTM A653M.

.13 Perforated Sheet Steel: Commercial flattened sheet steel of thickness indicated, with machine die cut round holes of 3 mm dia. at 5.537 mm oc in 60° staggered pattern and similar to sheet stock manufactured by Greening Donald Co. Ltd., or by Unalloy WRC-a division of Samuel Manu-Tech Inc. or by Gerard Daniel Worldwide.

.14 Expanded Steel Mesh: Flattened, expanded, carbon steel mesh of 10 msg gauge thickness, weighing minimum 112 lbs/100 sq ft, style 1.330" SWD x 3.2000" LWD, 11-1/2" - No. 9 by Gerard Daniel Worldwide, Canadian Division, or Expanded Metal Corporation or Dramex International.

.15 Aluminum Extrusions: ASTM B209M, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063-T5 or T6 for aluminum. Ensure surfaces are free from defects impairing appearance, strength and durability.

.16 Aluminum Sheet: ASTM B221M, Minimum thickness 3 mm of type and characteristics to match finished extrusions; sheet which is not exposed shall be Utility Aluminum mill finished; for intricate forming with decorative finishes use AA 1100 and for siding and exposed panels use AA-3003 with specified finish.

.17 Handrail Wall Brackets: In accordance with OBC requirements and to meet design requirements indicated on Drawings.

.18 Grout:

.1 Cementitious, non shrinking, non expanding grout: 'Sika Grout 212' by Sika Canada Inc., or 'Non Shrink Structural Grout - Dry Pack Grout' by Euclid Chemical Company or 'Sealtight CG 86 Construction Grout' by W.R. Meadows.

.2 Epoxy, non-shrinking, non expanding grout: 'Sika Anchor Fix.

.3 Master Flow 100.

.4 Master Emaco ADH 1420.

2.2 FABRICATION

.1 Fabricate each item of work of this Section in accordance with following general requirements:

.1 Members square and straight.

.2 Members plumb and true.

.3 Joints accurately and tightly fitted.

.4 Intersecting members in true, finish planes.

.5 Fasteners concealed.

.2 Fabricate, fit and assemble work in shop where possible. Where shop fabrication is not possible, make trial assembly in shop.

.3 Provide hangers, rods, bars, bolts, anchors, brackets, rivets, bearing plate and bracing, fitting, drilling, stopping, soldering, as required for a complete assembly.

.4 Isolate dissimilar metals to prevent galvanic corrosion.

.5 Weld connections unless otherwise indicated.

.6 Shop Welding:

.1 Execute welding to avoid damage or distortion to work. Should there be, in the opinion of Consultant or Inspection Company, doubts as to adequacy of welds, they shall be tested for efficiency and any work not meeting Standards be removed and replaced with new work satisfactory to Consultant. Carry out welding in accordance with following standards:

.1 Fabricator shall be fully certified by Canadian Welding Bureau for fusion welding of steel structures to CSA W47.1 and for fusion welding of aluminum to CSA W47.2.

.2 CSA W48-M - for Electrodes (if rods are used, only coated rods are allowed).

.3 CSA W59-M - for design of connections and workmanship.

.4 CSA W117.2 - for safety.

.7 Thoroughly clean welded joints and steel exposed for a sufficient space to properly perform welding operation. Neatly finish welds. Ensure welds exposed to view and finish painted are continuous and ground smooth.

.8 Provide exposed metal fastenings and accessories of same material, texture, color and finish as base metal to which they are applied or fastened.

2.3 FINISHES

.1 Cleaning and Shop Painting:

.1 Clean steel to SSPC SP6 and remove loose mill scale, weld flux and splatter.

.2 Shop prime steel with 1 coat of primer paint to dry film thickness of 0.025 mm (1 mil). Paint on dry surfaces free from rust, scale, grease. Do not paint when temperature is lower than 7 deg C. Paint items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature, and humidity conditions.

.3 Shop prime non galvanized perimeter steel members and structural steel members to receive sprayed fire resistive materials with 1 coat of high performance corrosion protection primer to dry film thickness of 0.025 mm (1 mil). Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 deg C. Paint

items under cover and leave under cover until primer is dry. Follow paint manufacturer's recommendations regarding application methods, equipment, temperature, and humidity conditions.

.4 Shop prime galvanized steel in accordance with CAN/CGSB-85.10.

.5 Clean but do not paint surfaces being welded in the field and surfaces in contact after assembly.

.2 Hot Dip Galvanizing:

.1 After fabrication, hot dip galvanize specific miscellaneous steel items noted on Drawings and/or called for herein. Plug relief vents air tight. After galvanizing, remove plugs, ream holes to proper size and re-tap threads. Straighten shapes and assemblies true to line and plane after galvanizing. Repair damaged galvanized surfaces with "Galvafroid" by W.R. Meadows in accordance with manufacturer's printed directions.

.2 Galvanized members exposed to elements when in final location; members embedded in concrete; members specified in this Section or noted on Drawings.

.3 Hot-dip galvanize members, in accordance with CAN/CSA-G164-M and the requirements of following ASTM standards, with minimum coating weights or thickness as specified:

.1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123M; average weight of zinc coating per sq/ft of actual surface, for 4.8 mm and less thickness members 2 ounces, for 6 mm and heavier members 2.3 ounces.

.2 Iron and Steel Hardware: ASTM A153M; minimum weight of zinc coating, in ounces per sq ft of surface shall be in accordance with Table 1 of ASTM A153M, for the various classes of materials used on the Project.

.3 Steel Sheet: ASTM A653M; weight of zinc coating, per sq ft on both sides of sheet. Coating designation Z275 (G90), minimized spangle and chemically treated.

.3 Color: to be selected by Consultant.

.4 Aluminum: Exposed aluminum surfaces shall have clear anodized coating (Architectural Class II). Pre-treat aluminum with caustic tech treatment prior to applying integral, clear, anodic oxide coating. Apply clear, anodic oxide coating in accordance with AAMA 611, 0.4 mils minimum coating thickness and also conforms to Aluminum Finish Designation AA-M12C22A31, Architectural Class II. Protect clear anodized coating with removable protective film.

.5 Zinc-rich primer: Ready, mixed, zinc-rich primer conforming to CAN/CGSB-1.181.

.1 Acceptable material:

.1 Sealtight Galvafroid Zinc-Rich Coating by W.R. Meadows of Canada Limited.

.2 Zinc Clad No. 7 Organic Zinc Rich Primer by Sherwin Williams Company of Canada Ltd.

.6 Isolation Coating: Bituminous paint, alkali-resistant bituminous paint or epoxy resin solution to provide dielectric separation which will dry to be tack-free and withstand high temperatures. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers. Carboline Bitumastic 50 by Carboline Canada, or Copper Creek Top Service 760 Black by Sherwin Williams Company, 410-02 by Bakor Inc. or other Product and manufacturer acceptable to Consultant.

3 Execution

3.1 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
.4 Exposed fastening devices to match finish and be compatible with material through which they pass.
.5 Provide components for building by other sections in accordance with shop drawings and schedule.
.6 Make field connections with bolts to CAN/CSA-S16.1, or weld.
.7 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
.8 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 INSTALLATION

.1 Verify dimensions at the Place of the Work to ensure work of this Section fits to that of other parts of the Work.
.2 Erect the work of this Section plumb, square, true and level.
.3 Securely anchor work of this Section and rivet, weld or bolt to structural framing of the building. Where secured to concrete, Provide bolts for setting in concrete. Provide expansion bolt supports to masonry.
.4 Provide necessary fitting, setting and cutting required in connection with the fitting of work of this Section to other parts of the Work.
.5 Field Painting: Paint bolt heads, washers, nuts, field welds and previously unpainted items. Touch up with matching paint, shop primer damaged during transit and installation.
.6 Erect stair work to line, plumb, square, true and level, with runs of stairs registering level with floor levels.

3.3 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
.3 On completion of installation, carefully clean metal work.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 - Metal Fabrications.
.2 Section 09 91 00 - Painting.

1.2 REFERENCES

.1 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)
  .1 ANSI/NAAMM MBG 531-00, Metal Bar Grating Manual.
.2 American Society for Testing and Materials International, (ASTM)
  .1 ASTM A53/A53M-07, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  .2 ASTM A307-07b, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  .3 ASTM A325M-02, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
.3 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB 1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
  .2 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
  .3 CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  .4 CAN/CSA G164-18 (2023), Hot Dip Galvanizing of Irregularly Shaped Articles.
.4 Canadian Standards Association (CSA International)
  .1 CSA W59-18 (R2023), Welded Steel Construction (Metal Arc Welding).
.5 National Association of Architectural Metal Manufacturers (NAAMM)
  .1 NAAMM AMP 510-92, Metal Stairs Manual.
.6 Steel Structures Painting Council (SSPC), Systems and Specifications Manual, Volume 2.

1.3 SYSTEM DESCRIPTION

.1 Design metal stair, balustrade and landing construction and connections to NBC vertical and horizontal live load requirements.
.2 Detail and fabricate stairs to NAAMM Metal Stairs Manual.

1.4 QUALITY ASSURANCE

.1 Structural Design and Inspection:
  .1 Certification:
    .1 Submit certification from registered professional structural Engineering registered in the province of Prince Edward Island, who shall affix his/her seal and signature to certificate, stating structure is capable of supporting its own weight and specified live loads.
    .2 Welders employed on this project may be asked by Consultant at any time for their welding certificate.

1.5 SUBMITTALS

.1 Shop Drawings
  .1 Submit shop drawings in accordance with Division 01 - General Requirements.
  .2 Indicate construction details, dimensions, rise and run, sizes of steel sections and thickness of steel sheet.
  .3 Each shop drawing submitted shall bear stamp and signature of qualified professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MATERIALS

.1 Steel sections: to CAN/CSA-G40.20/G40.21 Grade 300 W.
.2 Steel plate: to CAN/CSA-G40.20/G40.21, Grade260 W.
.3 Steel pipe: to ASTM A53/A53M, standard weight, schedule 40 seamless black.
.4 Steel tubing: to CAN/CSA-G40.20/G40.21.
.5 Welding materials: to CSA W59.
.6 Bolts: to ASTM A307.

2.2 FABRICATION

.1 Fabricate to NAAMM, Metal Stair Manual.
.2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, color and finish as base material on which they occur.
.3 Accurately form connections with exposed faces flush; miters and joints tight. Make risers of equal height and treads of equal depth.
.4 Grind or file exposed welds and steel sections smooth.
.5 Shop fabricate stairs in sections as large and complete as practicable.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600g/m2 to CAN/CSA-G164.
.2 Shop coat primer: to CISC 1-73A Red Oxide Primer
.3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.4 STEEL CHANNEL TREAD STAIRS AND LANDINGS

.1 Form treads and landings with galvanized cold formed channel treads. Channel tread to have small perforated dimples. Channel tread to be 304mm wide x 50mm thick. Minimum 11 gauge. Bolt to stringers.
.2 Acceptable material: Amico, Safety tread square drainage.
.3 Nosing to be 6mm-13mm radius.
.4 Riser to be enclosed with 13 gauge galvanized sheet metal. Screw attach to underside of channel tread. Provide 19mm rake back.
.5 Form wall stringers from C310 x 31. Stair and landings.
.6 Form outer stringers from C310 x 31.Stair and landings.
.7 Provide clip angles for fastening of channels treads to stringers and landings.
.8 Extend all stringer ends around mid landings to form steel base.
.9 Close all ends of stringers where exposed.

2.5 HANDRAILS AND GUARDRAILS

.1 Refer to spec Section 05 52 00 - Metal Railings.

2.6 SHOP PAINTING

.1 Clean surfaces in accordance with Steel Structures Painting Council Manual Volume 2.
.2 Apply one coat of shop primer except interior surfaces of pans.
.3 Apply two coats of primer of different colors to parts inaccessible after final assembly.

.4 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 degrees C.
.5 Do not paint surfaces to be field welded.

3 Execution

3.1 INSTALLATION OF STAIRS AND LANDINGS

.1 Install in accordance with NAAMM, Metal Stair Manual.
.2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.
.3 Do welding work in accordance with CSA W59 unless specified otherwise.
.4 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.2 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

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1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.
.2 Section 05 51 00 - Metal Stairs
.3 Section 09 21 16 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.
.4 Section 09 91 00 - Painting

1.2 REFERENCE STANDARDS

.1 AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
.2 AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
.3 AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
.4 AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
.5 ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.
.6 ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
.7 ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2018.
.8 ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.
.9 ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating 2011 (Reapproved 2017).
.10 ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric) 2012.
.11 ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.
.12 ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2010e1.
.13 ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications 2013, with Editorial Revision (2014).
.14 ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2013, with Editorial Revision.
.15 ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).
.16 CAN/ULC S572 - Standard for Photoluminescent and Selfluminous Exit Signs and Path Marking Systems 2017.
.17 CISC Handbook - Handbook of Steel Construction 11 (R2017).
.18 CSA B651 - Accessible Design for the Built Environment 2012 (R2017).
.19 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel 2013.
.20 CSA S16:19 - Design of Steel Structures.
.21 CSA W47.1:19 - Certification of Companies for Fusion Welding of Steel.
.22 CWB 112E - Welding Symbols Study Guide 04-1.
.23 SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

.24 SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

1.3 SUBMITTALS

.1 See Division 01 - General Requirements, for submittal procedures.
.2 Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
  .1 Indicate fabrication and erection procedures, and include documents and materials lists required by CISC Handbook and CSA S16.
  .2 Indicate welded connections using The Canadian Welding Bureau (CWB) symbols (CWB 112E).
  .3 Each shop drawing submitted shall bear seal and signature of qualified professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.
.3 Designer's Qualification Statement.
.4 Fabricator's Qualification Statement.

1.4 QUALITY ASSURANCE

.1 Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the Province in which the Project is located, or personnel under direct supervision of such an engineer.
.2 Welder Qualifications: Show certification of welders employed on the Work, verifying CWB qualification within the previous 12 months.
.3 Fabricator Qualifications:
  .1 A qualified steel fabricator that is certified by the Canadian Institute for Steel Construction (CISC).
  .2 Fabricator: Certified to CSA W47.1.
  .3 A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

.1 Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of CSA S16, ASTM E985 and applicable Building Code.
.2 Distributed Loads: In accordance with applicable Building Code, design railing assembly, wall rails, and attachments to resist distributed force of 1.5 kN/m applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
.3 Concentrated Loads: In accordance with applicable Building Code, design railing assembly, wall rails, and attachments to resist a concentrated force of 1.0 kN applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
.4 Allow for expansion and contraction of members and building movement without damage to connections or members.
.5 Dimensions: See Drawings for configurations and heights.
  .1 Top Rails and Wall Rails: Max 43 mm diameter, round.
  .2 Intermediate Rails: Max 43 mm diameter, round.
  .3 Posts: Max 43 mm diameter, round.
  .4 Balusters: 16 mm round solid bar.
.6 Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

.1 For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
.2 For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
.3 For anchorage to stud walls, provide backing plates, for bolting anchors.
.4 Posts: Provide adjustable flanged brackets.

2.2 STEEL RAILING SYSTEM

.1 Rolled Steel Sections and Plate: CSA G40.20/G40.21, Grade 300W.
.2 Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
.3 Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.
.4 Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
.5 Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
.6 Straight Splice Connectors: Steel concealed spigots.
.7 Galvanizing: In accordance with requirements of ASTM A123/A123M.
.1 Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.
.8 Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

.1 Accurately form components to suit specific project conditions and for proper connection to building structure.
.2 Fit and shop assemble components in largest practical sizes for delivery to site.
.3 Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
.4 Welded Joints:
.1 Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
.2 Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
.3 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

3 EXECUTION

3.1 EXAMINATION

.1 Verify that site conditions are acceptable and are ready to receive work.

3.2 PREPARATION

.1 Clean and strip primed steel items to bare metal where site welding is required.
.2 Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
.3 Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's instructions.
.2 Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
.3 Install railings in compliance with CSA B651 for accessible design at applicable locations.
.4 Anchor railings securely to structure.

.5 Site weld anchors as indicated on Drawings. Touch-up welds with primer. Grind welds smooth.

.6 Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.4 TOLERANCES

.1 Maximum Variation From Plumb: 6 mm per floor level, non-cumulative.

.2 Maximum Offset From True Alignment: 3 mm.

.3 Maximum Out-of-Position: 3 mm.

3.5 SCHEDULE

.1 Refer to the Drawings.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete
.2 Section 08 11 13 - Metal Doors and Frames
.3 Section 08 51 13 - Aluminum Windows

1.2 REFERENCES

.1 ANSI A135.4-2012 - Basic Hardboard Standard.
.2 ASTM A123/A123M-15 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.3 ASTM A153/A153M-09 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
.4 ASTM A653/A653M-13 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.5 CAN/CGSB 11.3-M87 - Hardboard.
.6 CANPLY (Canadian Plywood Association) - Canadian Plywood Handbook.
.7 CAN/CSA-O80 Series-08 (R2012) - Wood Preservation.
.8 CAN/ULC-S706-09 - Standard for Wood Fibre Insulating Boards for Buildings.
.9 CSA-O121-08 (R2013) - Douglas Fir Plywood.
.10 CSA-O151-09 (R2014) - Canadian Softwood Plywood.
.11 CSA-O153-13 - Poplar Plywood.
.12 CSA-O437 Series-93 (R2011) - Standards on OSB and Waferboard.
.13 NLGA (National Lumber Grades Authority) - Standard Grading Rules for Canadian Lumber, 2014 Edition.
.14 NPA A208.1-2009 - Particleboard.
.15 NPA A208.2-2009 - Medium Density Fibreboard (MDF) for Interior Applications.

1.3 SUBMITTALS FOR REVIEW

.1 As per Division 01 - General Requirements.

1.4 SUBMITTALS FOR INFORMATION

.1 As per Division 01 - General Requirements.

1.5 CLOSEOUT SUBMITTALS

.1 As per Division 01 - General Requirements.

1.6 QUALITY ASSURANCE

.1 Perform Work in accordance with the following agencies:
  .1 Lumber Grading Agency: Certified by NLGA.
  .2 Plywood Grading Agency: Certified by CANPLY.
  .3 Wood Based Panel Products: Marked with a recognized, visible grade stamp showing Grade or span rating as required.
.2 Pressure Preservative Treated Wood: Marked with certification mark authorized by the Canadian Wood Preservers Bureau (CWPB) indicating producer, preservative type, retention and Use Category (UC).

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Transport, handle, store, and protect products all as per Division 01 - General Requirements.
.2 Store plywood panels flat and level.
.3 Keep finish faces inward and cover stacks to protect from bumping and abrasion.
.4 Protect tongue and groove plywood panel edges and corners.

.5 Protect panels from sunlight, water or excessive humidity.
.6 Store materials off the ground, covered with weatherproof tarps, indoors in dry, well-ventilated area.

2 Products

2.1 LUMBER MATERIALS

.1 Dimension Lumber: CSA-O141, softwood lumber unless indicated otherwise, S4S, maximum moisture content 19%, graded to NLGA Standard Grading Rules for Lumber. Finger jointed lumber not acceptable.
  .1 Studs - Non-Structural: Grade, Construction Stud, Standard or No. 3; Species Spruce-Pine-Fir, Douglas Fir-Larch, Hem-Fir or any species.
  .2 Utility Shelving: Grade Construction, Standard, No. 3 or No. 2; Species: any species
  .3 Blocking, Curbs and Sleepers: Grade No. 2, species: spruce.

2.2 PANEL MATERIALS

.1 Plywood: CSA-O121, CSA-O151 and CSA-O153 as indicated in schedule below, certified and graded by CANPLY, meeting the requirements of CSA-O325.

2.3 FASTENERS AND ANCHORS

.1 Screws and Nails: Galvanized steel, type and size suitable for application.
.2 Anchors: Galvanized steel, toggle bolt type for anchorage to hollow masonry, expansion shield and lag bolt type for anchorage to solid masonry or concrete and bolt or ballistic fastener for anchorages to steel.

2.4 MISCELLANEOUS ACCESSORIES

.1 Adhesives: Waterproof adhesive, approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work, as required by Division 01 - General Requirements.
.2 Verify that site conditions are ready to receive work and opening dimensions are as indicated on Shop Drawings or as instructed by the manufacturer.

3.2 INSTALLATION

.1 Set members level and plumb, in correct position. Place horizontal members, crown side up.
.2 Construct curb members of single pieces.
.3 Place horizontal members, crown side up.
.4 Curb roof openings, except where prefabricated curbs are provided. Form corners by alternating lapping side members.
.5 Coordinate curb installation with installation of parapet construction, roofing vapour retardant and decking and support of deck openings.

3.3 ERECTION TOLERANCES

.1 Tolerances: as per Division 01 - General Requirements.
.2 Framing Members: 6 mm (1/4 inch) from true position, maximum.
.3 Surface Flatness of Floor: 2 mm in 1 m (1/4 inch in 10 ft) maximum, and 13 mm in 9 m (1/2 inch in 30 ft) maximum.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This section specifies the requirements for the supply and installation of the elements required for waterproofing below grade structures.
.2 Waterproofing system: Self-adhesive SBS modified bitumen membrane.

1.2 RELATED REQUIREMENTS

.1 Section 07 92 00 - Joint Sealants.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.
.2 Submit two (2) copies of the most current technical data sheets. These documents must describe the physical properties of the material.

1.4 QUALITY ASSURANCE

.1 Manufacturer Qualifications:
  .1 The manufacturer of elastomeric bitumen products will provide proof of ISO 9001 and ISO 14001 certifications.
.2 Contractor Qualifications:
  .1 Waterproofing work shall be performed only by skilled applicators, employed by an installation contractor operating all adequate and necessary equipment to execute such work in accordance with the manufacturer's recommendations and recognized standards.
.3 Manufacturer's Representative
  .1 The waterproofing materials manufacturer may delegate a representative to visit the work site at commencement of work.
  .2 At all times, the contractor shall permit and facilitate access to the site by the manufacturer's representative cited above.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Division 01 - General Requirements.
.2 Store materials in accordance with manufacturer's written instructions.
.3 Rolls of materials should be handled with care and proper equipment.
.4 Rolls of materials shall be carefully stored and adequately protected in accordance with the manufacturer's recommendations.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

1.7 WARRANTY

.1 The product manufacturer shall issue a written and signed document in the name of the owner, certifying the product will meet all the physical characteristic published by the manufacturer, for a period of five (5) years, starting from the date of completion of installation of membranes. No letter amending the manufacturer's standard warranty will be accepted and the warranty certificate must reflect these requirements.

2 Products

2.1 WATERPROOFING MEMBRANE

.1 Description: A self-adhesive waterproofing membrane composed of SBS modified bitumen and a Tri-Laminate Woven Polyethylene facer. The self-adhesive side is covered by a silicone release sheet.

.2 Characteristics:

.1 Thickness: 1.5 mm

.2 Roll Size: Width: 1 m / Length: 18.7 m

.3 Strain energy (kN/m): (MD) = 3.1 (XD) = 1.7

.4 Ultimate elongation (%): (MD) =40 (XD) =25

.5 Static puncture resistance (N): 400

.6 Tear resistance (N): (MD) = 375 (XD) = 400

.7 Tensile strength (kN/m): (MD) = 11.3 (XD) = 15.4

.3 Acceptable material:

.1 COLPHENE 3000 by Soprema.

2.2 PRIMER FOR SELF-ADHESIVE MEMBRANES

.1 Description: Primer composed of SBS synthetic rubber, adhesive resins and volatile solvents. Used as primer to improve the adhesion of self-adhesive membranes.

.2 Acceptable Material:

.1 Elastocol Stick by Soprema

2.3 ACCESSORIES

.1 Waterproofing Mastic

.1 Description: A black, solvent-based mastic containing SBS modified bitumen, fibres and mineral fillers.

.2 Acceptable material:

.1 SOPRAMASTIC by Soprema

.2 Protection / Insulation Board:

.1 Refer to Section 07 21 13 - Board Insulation.

3 Execution

3.1 EXAMINATION AND PREPARATION OF SURFACES

.1 Surface examination and preparation must be completed in conformance with manufacturer's recommendations.

.2 Before waterproofing work begins, the Owner's Representative and the membrane Contractor's Foreman will inspect and approve substrate condition and ensure that related work has been properly executed. If necessary, a non-conformity notice will be issued to the Contractor so that required corrections can be made. The start of the membrane application will mean that substrate conditions are acceptable for work completion.

.3 Before commencing work, all surfaces must be smooth, dry, clean and free of ice and debris as per manufacturer's recommendations.

.4 No materials will be installed during rain or snowfall.

.5 Concrete must be cured a minimum of fourteen (14) days and an adhesion test is recommended before membrane application.

.6 Verify the compatibility of all membrane components with curing compounds, coatings or other materials which are already installed on the surfaces to be treated.

.7 Any cracks over 3 mm wide should be reported to the design professional. After approval from the qualified authority, the crack should be filled in with waterproofing mastic. A 150 mm (6 inches) wide strip of membrane should be installed, centered over the crack.

3.2 METHOD OF EXECUTION

.1 Work shall be performed on a continuous basis as surface and weather conditions allow.
.2 Adjoining surfaces shall be protected against any damage that could result from the waterproofing installation.

3.3 EQUIPMENT

.1 Maintain all equipment and tools in good working order.

3.4 PRIMER APPLICATION

.1 Surface where membrane is applied shall receive an SBS synthetic rubber primer coating at the rate of: (porous surfaces: 0.3 to 0.5 L/m2, non-porous surfaces: 0.1 to 0.25 L/m2). . If not covered the same day, primed surfaces must be re-primed.

3.5 WATERPROOFING MEMBRANE INSTALLATION

.1 Select the proper product according to temperatures during application. For membrane applications at temperatures below 10º C, contact your local Soprema representative.
.2 All small protrusions (pipes, etc.) through the waterproofing membrane, should be pre-stripped with a membrane and sealed with waterproofing mastic.
.3 To begin application, align the first roll of membrane to a previously drawn chalk line.
.4 All edges must be pre-stripped with a 150 mm (6 in.) wide strip of membrane centered on the corner. This membrane must be installed in direct contact with the substrate not leaving any voids under the membrane strip.
.5 Install the membrane onto the primed surface by peeling back the paper backing on the underside and adhering the membrane to the surface.
.6 Subsequent rolls must be installed in the same manner and should be aligned with the preceding roll with a side lap of at least 75 mm. End laps must be overlapped at least 150 mm.
.7 Holes and tears in the membrane must be repaired with the appropriate membrane material. The repair must exceed the affected surface area by at least 75 mm. The membrane piece applied for the repair must be sealed around its edges with mastic.
.8 Use a roller approved by manufacturer to apply pressure over the entire surface of the membrane to ensure perfect adhesion.
.9 The Contractor shall verify meticulously the membrane installation at the end of each day of work and before backfilling.
.10 All inside corner overlaps should be sealed with a bead of mastic after membrane installation.
.11 The uppermost edge of the membrane is to be mechanically fastened to the concrete substrate using applicable fasteners and termination bars.
.12 Apply mastic on the top edge of membrane to prevent water infiltration.
.13 Any waterproofing membrane left exposed after backfilling shall be protected from ultra violet and mechanical damages.

3.6 INSULATION INSTALLATION- PERIMETER FOUNDATION

.1 Install the panels vertically or horizontally on the foundation wall so as to minimize the number of joints.
.2 Place the panels by offsetting vertical joints and abut the panels to each other perfectly to ensure continuous thermal insulation.
.3 Cut and adjust the insulating panels around pipes, electrical and mechanical elements, openings and any other penetrations.
.4 Stop the insulation at least 75 mm (3") around devices that emit heat.
.5 When another layer of insulation is required, it must be installed with staggered vertical and horizontal joints.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-in-Place Concrete.
.2 Section 07 21 16 - Blanket Insulation.
.3 Section 07 26 00 - Vapour Retarders.
.4 Section 07 46 19 - Steel Siding.
.5 Section 07 52 00 - Modified Bituminous Membrane Roofing.
.6 Section 09 21 16 - Gypsum Board Assemblies.
.7 Section 09 22 16 - Non-Structural Metal Framing.
.8 Section 31 23 00 - Excavation and Fill.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM E96-00e1, Test Methods for Water Vapor Transmission of Materials.
  .2 ASTM C208-95(R2001), Specification for Cellulosic Fiber Insulating Board.
  .3 ASTM C591-01, Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
  .4 ASTM C612-00a, Specification for Mineral Fiber Block and Board Thermal Insulation.
  .5 ASTM C165 (2012), Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
  .6 ASTM C665 (2011), Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  .7 ASTM C728-97e1, Specification for Perlite Thermal Insulation Board.
  .8 ASTM C1126-00, Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
  .9 ASTM C1289-02, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
  .10 ASTM C1338 (2008), Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
.2 Canadian General Standards Board (CGSB).
  .1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.
.3 Underwriters Laboratories of Canada (ULC).
  .1 CAN/ULC-S102 (2010), Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  .2 CAN/ULC-S604-91, Type A Chimneys.
  .3 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
  .4 CAN/ULC-S702 (2012), Standard for Thermal Insulation Mineral Fibre for Buildings.
  .5 CAN/ULC-S704-01, Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

1.3 QUALITY ASSURANCE

.1 Pre-Installation Meetings: attend pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 ROOF INSULATION & TAPERED ROOF INSULATION

.1 Rigid Cellular Poly-isocyanurate, to thickness indicated.
  .1 Faced: to ASTM C 1289-98, glass fiber reinforced polyisocyanurate core, surfaced with glass fiber faces. Minimum two layers with joints staggered.
.2 Tapered insulation minimum 1% slope to drains.
.3 Insulation at roof drains is to be a minimum of R30 at square sump at roof drains.
.4 Thermal Resistance: R Value per inch = 6.0.
.5 Acceptable Material:
  .1 IKO Therm Poly-Isocyanurate Insulation.
  .2 Soprema, Sopra-Iso.

2.2 CONCRETE SLABS ON GRADE

.1 Extruded polystyrene to CAN/ULC S701-97, Type IV, ship lapped, to thickness indicated.
.2 Minimum compressive strength: 210 kPA (30 psi).
.3 Thermal Resistance: R Value per inch = 5.0.
.4 Compressive Strength: 30 PSI min.
.5 Acceptable Material:
  .1 Celfort Celfortec-300
  .2 Dow Styrofoam SM.
  .3 Dow Styrofoam High Load 60.
  .4 Sopra-XPS 30 by Soprema.

2.3 ADHESIVE

.1 Synthetic rubber base insulated Type A adhesive having a moisture permeability of 1.71 ng/Pa.s.m2.
.2 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

2.4 ACCESSORIES

.1 Mechanical fasteners in accordance with insulation manufacturer's written recommendations.
.2 Insulation clips: in accordance with manufacturer's written recommendations.
.3 Foundation sealing compound: Bitumen sealing compound.
.4 Adhesive: All purpose construction adhesive in accordance with insulation manufacturer's written recommendations.

3 Execution

3.1 EXAMINATION

.1 Examine substrates and immediately inform Consultant in writing of defects.
.2 Prior to commencement of work ensure: substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.
.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN4-S604 type A chimneys.
.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
.6 Offset both vertical and horizontal joints in multiple layer applications.
.7 Do not enclose insulation until it has been inspected and approved by Consultant.

3.4 RIGID INSULATION INSTALLATION

.1 Apply adhesive in accordance with manufacturer's recommendations.
.2 Embed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.
.3 In addition to adhesive, install insulation boards with insulation clips and disk, per manufacturer requirements.
.4 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

3.5 UNDERSLAB INSULATION

.1 Under horizontal slab application: extend boards to the dimension indicated on the drawings. Lay boards on level compacted fill.

3.6 ROOF INSTALLATION

.1 Install to depths indicated on drawings. See Section 07 52 00 - Modified Bitumen Membrane Roofing.

3.7 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 21 13 - Board Insulation.
.2 Section 07 26 00 - Vapour Retarders.
.3 Section 07 46 19 - Steel Siding
.4 Section 09 22 16 - Non-Structural Metal Framing

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM C167, Standard Test Method for Thickness and Density of Blanket or Batt Thermal Insulations.
  .2 ASTM C356, Standard Test Method for Linear Shrinkage of Performed High-Temperature Thermal Insulation Subjected to Soaking Heat.
  .3 ASTM C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  .4 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  .5 ASTM C553-02, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  .6 ASTM C665-01e1, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  .7 ASTM C1320-99, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
  .8 ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  .9 ASTM E413, Classification for Rating Sound Insulation.
  .10 ASTM E1050, Standard Test Method for Impedance and Absorption of Acoustical Materials using a Tube, Two Microphones and a Digital Frequency Analysis System.
.2 Underwriters Laboratories of Canada (ULC).
  .1 CAN/ULC S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  .2 CAN/ULC S114, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
  .3 CAN/ULC S115, Standard Method of Test Firestop Systems.
  .4 CAN/ULC-S604-1991, Type A Chimneys.
  .5 CAN/ULC-S702-1997, Standard for Thermal Insulation Mineral Fiber for Buildings.

1.3 SUBMITTALS

.1 Make submittals in accordance with Contract conditions and Division 01 - General Requirements.
.2 Product Data: Submit project data including manufacturer's literature for insulation materials and accessories, indicating compliance with specified requirements and material characteristics.
  .1 Submit list on insulation manufacturer's letterhead of materials and accessories to be incorporated into the Work.
  .2 MSDS report.
  .3 Include product name.
  .4 Include preparation instructions and recommendations, installation methods and storage and handing requirements.
  .5 Include contact information for manufacturer and their representative for this project.
.3 Samples:

.1 If requested, submit 140mm x 190mm minimum sample of insulation in thickness used on project.

.4 Test Reports:

.1 Submit evaluation service reports or other independent testing agency reports, showing compliance with specified performance characteristics and physical properties.

.5 Field Reports:

.1 Submit manufacturer's field reports within three (3) days of each manufacturer representative's site visit and inspection.

.6 Insulation Installer Qualifications:

.1 Submit letter verifying insulation installer's experience with work similar to work of this Section.

1.4 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Supply maintenance data for insulation materials for incorporation into manual specified in Division 01 - General Requirements.

.2 Record Documentation: In accordance with Division 01 - General Requirements.

.1 List materials used in insulation work.

.2 Warranty: Submit warranty documents specified.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver and acceptance requirements:

.1 Deliver material in accordance with Division 01 - General Requirements.

.2 Deliver materials and accessories in insulation manufacturer's original packaging with identification labels intact and in sizes to suit project.

.3 Ensure insulation materials are not exposed to moisture during delivery.

.4 Replace wet or damaged insulation materials.

.2 Storage and handling requirements: Store materials off ground in dry location and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

.1 Store in original packaging until installed.

1.6 QUALITY ASSURANCE

.1 Pre-installation Meetings: attend pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 WARRANTY

.1 Manufacturer's warranty: Submit for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other rights the Owner may have under Contract conditions.

.2 Warranty period, one (1) year commencing on date of Substantial Performance of Work.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.

.2 Place in appropriate on-site bins in accordance with Waste Management Plan.

.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 INSULATION - ACOUSTIC

.1 Acoustical and fire batt insulation for walls and floors to CAN/ULC S702, Type 1.

.1 Fire Performance:
  .1 Non-combustibility: To CAN/ULC S114.
  .2 Surface burning characteristics: To CAN/ULC S102.
    .1 Flame spread: 0.
    .2 Smoke developed: 0.
.2 Acoustical Performance:
  .1 Airborne sound transmission loss: To ASTM E90.
  .2 Rating sound insulation: To ASTM E413.
  .3 Sound absorption co-efficients: To ASTM E423.
  .4 Impedance and absorption of acoustic materials: To ASTM E1050.
.3 Acceptable Material:
  .1 Rockwool, AFB, Acoustical Fire Batt.

2.2 INSULATION - THERMAL

.1 Thermal batt insulation for exterior stud walls: To CAN/ULC S702, Type 1.
  .1 Fire performance:
    .1 Non-combustibility: To CAN/ULC S114.
    .2 Surface burning characteristics: To CAN/ULC S102.
      .1 Flame spread: 0.
      .2 Smoke developed: 0.
    .3 Thermal Resistance: R Value per 152mm = 24.
  .2 Acceptable Materials:
    .1 EcoTouch - Owens Corning.
    .2 Unfaced Fiber Glass Batts - Johns Manville.
    .3 CertainTeed Insulation Canada.
    .4 Knauf Insulation - Ecobatt Thermal.

2.3 INSULATION FOR FIRESTOPPING

.1 Insulation for firestopping installations to ASTM C612.
  .1 Fire performance:
    .1 Non-combustibility: To CAN/ULC S114.
    .2 Surface burning characteristics: To CAN/ULC S102.
      .1 Flame spread: 0.
      .2 Smoke developed: 0.
  .2 Acoustical Performance:
    .1 Airborne sound transmission loss: To ASTM E90.
    .2 Rating sound insulation: To ASTM E413.
    .3 Sound absorption co-efficients: To ASTM E423.
    .4 Impedance and absorption of acoustic materials: To ASTM E1050.
  .3 Acceptable Material:
    .1 Rockwool, AFB, Acoustical Fire Batt.

2.4 ACCESSORIES

.1 Staples: 12.7mm minimum leg.
.2 Tape: as recommended by manufacturer.
.3 Mechanical fasteners in accordance with insulation manufacturer's written recommendations.
.4 Acoustical sealant in accordance with Section 07 92 00 Joint Sealants.
.5 Firestopping materials in accordance with Section 07 84 00 - Firestopping.

3 Execution

3.1 INSULATION INSTALLATION

.1 Install thermal or acoustic insulation between studs to maintain continuity of thermal or acoustical protection to building elements and spaces.

.2 Install insulation in areas as indicated. Friction-fit in position installed as recommended by manufacturer.
.3 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
.4 Do not compress insulation to fit into spaces.
.5 Keep insulation minimum 75mm from heat emitting devices such as recessed light fixtures, and minimum 50mm from sidewalls of CAN/CGA-B149.1 and CAN/CGA-B149.2 Type B vents.
.6 Seal joints with acoustical joint sealant.
.7 Do not enclose insulation until it has been inspected and approved by Consultant.
.8 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 21 16 - Blanket Insulation
.2 Section 07 27 00 - Air Barriers
.3 Section 07 92 00 - Joint Sealants.
.4 Section 09 21 16 - Gypsum Board Assemblies
.5 Section 09 22 16 - Non Structural Metal Framing

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-51.34-M86, Vapor Barrier, Polyethylene Sheet, for Use in Building Construction.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Division 01 - General Requirements.
.2 Submit product data sheets for sheet vapour retarders. Include the following:
  .1 Product characteristics.
  .2 Performance criteria.
  .3 Limitations.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.
.4 Place materials defined as hazardous or toxic waste in designated containers.
.5 Use the least toxic sealants and adhesives necessary to comply with requirements of this section.
.6 Place used hazardous sealant tubes and adhesive containers in areas designated for hazardous materials.

2 Products

2.1 SHEET VAPOUR BARRIER

.1 Polyethylene film: 6mil thick above grade, 10mil thick below grade

2.2 SELF ADHESIVE VAPOUR BARRIER

.1 Air/vapour barrier membrane (Self-Adhering): SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, and having the following physical properties:
  .1 Thickness: 1.0 mm;
  .2 Vapour permanence: < 2.5 ng/Pa•s•m² (< 0.04 perm) to ASTM E96;
  .3 Acceptable Materials:
    .1 Henry - Blueskin SA.
    .2 Soprema - Sopraseal Stick 1100 T.

2.3 ACCESSORIES

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, cloth fabric duct tape, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: EcoLogo certified, not to contain total of volatile organic compounds in excess of 5 % by weight, asbestos-free sealant, compatible with vapour retarder materials, recommended by vapour retarder manufacturer and as specified in Section 07 92 00 - Joint Sealants.
.3 Staples: minimum 6 mm leg.
.4 Molded box vapour barrier: factory-molded polyethylene box for use with recessed electric switch and outlet device boxes.

3 Execution

3.1 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.
.2 Install sheet vapour retarder on warm side of exterior wall assemblies prior to installation of gypsum board to form continuous retarder.
.3 Use sheets of largest practical size to minimize joints.
.4 Tie vapour retarder into roof membrane.
.5 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.2 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to all door and window frames.

3.3 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:
  .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
  .2 Lap sheet over sealant and press into sealant bead.
  .3 Install staples through lapped sheets at sealant bead into wood substrate.
  .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:
  .1 Attach first sheet to substrate.
  .2 Apply continuous bead of sealant over solid backing at joint.
  .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
  .4 Install staples through lapped sheets at sealant bead into wood substrate.
  .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
  .1 Install molded box vapour barrier.
  .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 26 00 - Vapour Retarders.
.2 Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

.1 At least four (4) weeks prior to commencing installation of air/vapour barrier membrane submit sample of membrane for Consultants review and approval.

1.3 QUALITY ASSURANCE

.1 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials.
.2 Manufacturer's Representative to visit the site during the installation of the preparation for and installation of the first two (2) mock-ups. Manufacturer's Representative to review mock-up and provide a written report confirming the installation is in accordance with Manufacturer's requirements.

1.4 QUALITY ASSURANCE MOCK-UP

.1 Fabricate a mock-up that will demonstrate the various aspects of the air barrier / window connection / cladding (brick, steel, wood, EIFS and/or vinyl) installation and detailing.
.2 The installation is to reflect the intent to have a full tie in of the air barrier to the entire perimeter of all wall openings, including windows, doors and louvers, providing a tight air and water seal and the relationship of the cladding installation to the openings.
.3 The mock-up is to be reviewed by the Contractor, Membrane Installer, Window Installer, Owner and Consultant prior to the Contractor moving forward with the installation of all other windows.
.4 Allow 24 hours to convene the review on site.
.5 Mock-up to be approved prior to fabrication of additional openings.
.6 Openings installed prior to review and approval will be removed at the Contractors expense and rebuilt.
.7 The approved mock-up may remain on site as part of the work and it will form the standard of acceptance for the remainder of the work.

1.5 QUALIFICATIONS

.1 Applicator: Company specializing in performing work of this section with minimum 3 years documented experience with installation of air/vapour barrier systems.

1.6 PRE- INSTALLATION MEETINGS

.1 Attend a pre installation meeting to verify project requirements, manufacturers installation instructions, tie ins & quality expectations.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Division 01 - General Requirements.
.2 Deliver, store and handle materials in accordance with manufacturer(s written instructions.

1.8 SEQUENCING

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.9 GUARANTEES

.1 The product manufacturer shall issue a written and signed document, issued in the name of the Owner, certifying the product will meet all the physical characteristics published by the manufacturer, for a period of five (5) years, starting from the date of Substantial Completion.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 SHEET MATERIALS

.1 Air barrier membrane (Self-Adhering): vapour permeable, water resistive air barrier consisting of an engineered film surface and having the following physical properties:
  .1 Thickness: 0.58mm
  .2 Air leakage: Pass, ASTM E2357
  .3 Vapour permeance: 29 Perms, ASTM E96, Method A
  .4 Low temperature flexibility: Pass, ICC-ES AC38/3.3.4
  .5 Acceptable Materials:
    .1 Henry, Blueskin VP160
.2 Through-wall flashing membrane (Self-Adhering): SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, having the following physical properties:
  .1 Thickness: 1.0 mm.
  .2 Vapour permeance: < 2.5 ng/Pa•s•m² (< 0.04 perm) to ASTM E96;
  .3 Acceptable Materials:
    .1 Blueskin SA
    .2 Soprema - Sopraseal Stick 1100 T.
.3 Primer: By manufacturer of membrane, all membranes to be primed.

3 Execution

3.1 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept the Work of this section.
.2 Ensure all surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer(s requirements.
.3 Report any unsatisfactory conditions to the Consultant in writing.
.4 Do not start work until deficiencies have been corrected. Commencement of Work implies acceptance of conditions.

3.2 PREPARATION

.1 Remove loose or foreign matter which might impair adhesion of materials.
.2 Ensure all substrates are clean of oil or excess dust; all masonry joints struck flush, and open joints filled; and all concrete surfaces free of large voids, spalled areas or sharp protrusions.
.3 Ensure all substrates are free of surface moisture prior to application of self-adhesive membrane and primer.
.4 Ensure metal closures are free of sharp edges and burrs.
.5 Prime substrate surfaces to receive adhesive in accordance with manufacturer's instructions.

3.3 INSTALLATION

.1 Apply primer to all surfaces to receive membrane in a manner and at a rate recommended by manufacturer. Primed surfaces not covered by membrane during the same working day must be re-primed.

.2 Seal end of membrane to substrate at end of days work and around any projections through membrane using only sealant recommended by membrane manufacturer.

.3 Carry membrane around into all wall openings and seal at frames or other building components. Reinforce all corners with adhesive applied membrane using heated trowel to ensure joint tightness.

.4 Coordinate with installation of roofing vapour barrier to ensure continuity of air/vapour barrier membrane at roof/wall intersections.

.5 Where work of other trades is incomplete leave sufficient membrane to complete work of this Section to ensure continuity and integrity of air/vapour barrier.

3.4 PROTECTION OF WORK

.1 Do not permit adjacent work to damage work of this section.

.2 Ensure finished Work is protected from climatic conditions.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 - Metal Fabrications.
.2 Section 07 21 13 - Board Insulation.
.3 Section 07 62 00 - Sheet Metal Flashing and Trim.
.4 Section 07 92 00 - Joint Sealants.
.5 Section 08 51 13 - Aluminum Windows.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
  .1 ANSI B18.6.4-99, Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws.
  .2 ANSI B18.6.4-1981 (R1991), Screws, Tapping and Metallic Drive, Inch Series, Thread forming and Cutting.
.2 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  .2 CAN/CGSB-93.4-92, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.
.3 Canadian Standards Association (CSA International).
  .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
  .2 CAN/CSA S16.1-94, Limit States Design of Steel Structures.
  .3 CSA S136-94, Cold Formed Steel Structural Members.
  .4 CSA S136.1-95, Commentary on CSA Standard S136-94, Cold Formed Steel Structural Members.
.4 Environmental Choice Program (ECP).
  .1 CCD-045-95, Sealants and Caulking Compounds.
.5 Underwriters' Laboratories of Canada (ULC).
  .1 CAN/ULC-S706-02, Wood Fiber Thermal Insulation for Buildings.
.6 CSSBI: 20M-91, Sheet Steel Cladding for Architectural and Industrial Applications.
.7 NBCC-2015, National Building Code of Canada.

1.3 DESIGN CRITERIA

.1 Design metal panels in accordance with the requirements of CSA S136-94 and CSA S136.1-95 and NBCC and CSSBI standards.
.2 Design metal wall cladding system to provide for thermal movement of component materials caused by ambient temperature range of 60°C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
.3 Provide an effective air barrier, to prevent infiltration and/or exfiltration of air through wall assembly.
.4 Design system to include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, (wind and snow loads) without permanent distortion, damage to filling materials, racking of joints, breakage of seals, or water penetration.
.5 Design members to withstand dead load and wind loads, and, where applicable, live loads, calculated in accordance with NBC and applicable local regulations, to maximum allowable deflection of 1/180th of span.
  .1 Sheet steel base thickness to be as specified with girt spacing determined by design criteria, but NOT to exceed 1800mm o.c.
  .2 Design sheets according to the specified tolerances for the erection of the structural support.
.6 Design system to attain water impermeable wall screen assembly for protection against driving wind forces and water capillary action. Incorporate in assembly, system of gaskets,

seals and closures to achieve intended design. Provide for positive drainage of condensation occurring within wall construction.

.7 Maintain following installation tolerances:
- .1 Maximum variation from plane or location shown on approved shop drawings: 20mm/10m of length.
- .2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 1.00 mm.

.8 Permanence through wall system shall not exceed 30 ng/Pa.s.m2

.9 Design wall system to allow for movement of air between exterior and interior side of metal cladding.

1.4 SUBMITTALS

.1 General:
- .1 Make submittals in accordance with Division 01 - General Requirements.

.2 Product Data:
- .1 Submit product data including manufacturer product sheet, for specified products.

.3 Shop Drawings:
- .1 Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors and textures.
- .2 Include details showing thickness and dimensions of the various system parts, fastening and anchoring methods, locations of joints and gaskets and location and configuration of joints necessary to accommodate thermal movement.
- .3 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, soffits, fascia, metal furring, and related work.
- .4 Indicate elevations of all walls showing wall openings and all pertinent dimensions, materials, and finishes, details at head, jamb and sills at all wall openings and at top, bottom, corners and other intersections including where siding abuts existing work. Include details of girt system including anchoring details, panel fastening details and compliance with design criteria and requirements of other work.
- .5 Each shop drawing submitted shall bear stamp and signature of qualified professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.

.4 Samples:
- .1 Submit selection and verification samples for finishes, colors and textures.
- .2 Verification Samples: 203 x 203 mm sample panels in thickness specified, including chips, anchors, supports, fasteners, closures and other panel accessories, for assembly approval.
- .3 Include panel assembly samples not less than 305 x 305 mm, showing 4 way joint.

.5 Test Reports:
- .1 Certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Certificates:
- .1 Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements.

.7 Manufacturer's Instructions:
- .1 Manufacturer's Installation Instructions
- .2 Manufacturer's Field Reports

.8 Closeout Submittals. Submit the following:
- .1 Warranty documents specified herein.

1.5 QUALITY ASSURANCE

.1 Installer Qualifications:
- .1 Installer experienced in performing work of this section who has specialized in the installation of work similar to that required for this project.

.2 Manufacturer Qualifications
  .1 Manufacturer capable of providing field service representation during construction and approving acceptable fabricator.
  .2 Company with a minimum of five (5) years of continuous experience manufacturing panel material of the type specified and capable of providing the following information.
  .3 List of five (5) other projects of similar size, including approximate date of installation and name of Consultant for each.
.3 Fabricator Qualifications
  .1 Company with at least three (3) years of experience on similar sized metal panel projects and approved by panel material manufacturer.

1.6 QUALITY ASSURANCE MOCK-UP

.1 Fabricate a mock-up that will demonstrate the various aspects of the air barrier / window connection / cladding (brick, steel, wood, EIFS and/or vinyl) installation and detailing.
.2 The installation is to reflect the intent to have a full tie in of the air barrier to the entire perimeter of all wall openings, including windows, doors and louvers, providing a tight air and water seal and the relationship of the cladding installation to the openings.
.3 The mock-up is to be reviewed by the Contractor, Membrane Installer, Window Installer, Owner and Consultant prior to the Contractor moving forward with the installation of all other windows.
.4 Allow 24 hours to convene the review on site.
.5 Mock-up to be approved prior to fabrication of additional openings.
.6 Openings installed prior to review and approval will be removed at the Contractors expense and rebuilt.
.7 The approved mock-up may remain on site as part of the work and it will form the standard of acceptance for the remainder of the work.

1.7 DELIVERY, STORAGE & HANDLING

.1 General:
  .1 Comply with Division 01 - General Requirements.
.2 Ordering:
  .1 Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
.3 Delivery:
  .1 Deliver materials in manufacturer's original, unopened, undamaged, containers with identification labels intact.
  .2 Package wall panels for protection against transportation damage. Provide markings to identify components consistently with drawings.
.4 Storage and Protection:
  .1 Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
  .2 Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.
  .3 Protect panels from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
  .4 Slope panels to ensure positive drainage of any accumulated water.
  .5 Do not store panels in any enclosed space where ambient temperature can exceed 49°C.
  .6 Protect finish of panels by applying heavy duty removable plastic film, during production.
  .7 Avoid contact with any other materials that might cause staining, denting, or other surface damage.

1.8 PROTECT CONDITIONS

.1 Field Measurements:
  .1 Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate filed measurements, fabrication schedule with construction progress to avoid construction delays.

1.9 WARRANTY

.1 Manufacturer's Warranty:
  .1 Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of other rights Owner may have under the Contract Documents.
  .2 Warranty Period: Two (2) years commencing on Date of Substantial Completion.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 SHEET METAL WALL CLADDING SYSTEM

.1 Exterior sheet metal panels:
  .1 Fabricate in accordance with ASTM A653/A653M.
  .2 Base metal thickness wall: 24 gauge.
  .3 Metal profile wall and soffits:
    .1 Acceptable Material:
      .1 VicWest - refer to the Drawings for profiles.
  .4 Finish:
    .1 Acceptable material:
      .1 Vicwest WeatherXLTM with Silicone Modified Polyester paint system.
  .5 Colour: refer to Drawings.
.2 Wall Cladding Flashings:
  .1 Visible moldings: corner flashings, cap and drip flashings, ridge caps, starter strips, trim at openings to be of same material, gauge and finish as the adjoining cladding, brake-formed to required profile.
  .2 Concealed moldings: all hidden components and clips shall be fabricated from hot-dipped galvanized steel, designation Z-275 (G-90) with minimum base metal thickness of 0.80 mm.
.3 Roof Parapet Flashings:
  .1 Same material, thickness, finished and colors as adjacent sheet metal siding and soffits fascias.
  .2 Supply to Section 07 62 00 - Sheet Metal Flashings and Trim sufficient flat material for all perimeter roof flashings and miscellaneous roof curb flashings.
.4 Accessories:
  .1 Metal closures: same thickness and finish as adjoining panels.
  .2 Foam closures: extruded, closed-cell, flexible PVC, same shape as cladding, arctic climate type.
.5 Fasteners:
  .1 Screws: to ANSI B18.6 and cladding manufacturer's recommendations.
.6 Touch-up Materials:
  .1 Color matched paint as supplied by cladding manufacturer.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 PREPARATION

.1 Protect metal surfaces in contact with concrete, masonry, mortar, plaster or other cementitious surfaces with isolation coating.

3.3 INSTALLATION OF SHEET METAL WALL CLADDING

.1 Install cladding to the requirements of CSSBI standards, manufacturer's written instructions and reviewed shop drawings.
  .1 Installation shall be performed by a company certified by the manufacturer of the metal cladding as an approved installer.
  .2 Install components to allow for thermal expansion and contraction.
  .3 Fold visible exposed edges of sheets inward at least 13 mm.
  .4 Provide alignment bars, brackets, clips, inserts, shims, as required to securely and permanently fasten wall cladding system to building structure.

.2 Install thermal breaks continuous over length of sub-girts. Screw fasten in accordance with design loading requirements.

.3 Install insulation in strict accordance with the requirements of Section 07 21 13 - Board Insulation.

.4 Install exterior panels c/w all required flashings and trim. Ensure that all fasteners at flashings and trim are concealed. Make sure all laps are perfectly aligned and joined. Use sufficient pressure when installing screws to ensure that the EPDM washers are fully seated, but without buckling the panels.

.5 Stitch the side laps of exterior sheets with screws between sub-girts at maximum 600 mm o.c.

.6 End laps at exterior panels to be minimum 100 mm, located over sub-girts and sealed with tape sealant.

.7 Make all necessary openings in the panels for mechanical and electrical purposes. Cut to fit tight around pipes and other accessories and seal with sealant.

.8 Install notched, shaped and waterproof closures to protect the cladding components against the effects of the weather.

3.4 PANELS

.1 Wall cladding: shop cut to required sizes and to provide openings for doors, windows, grilles and other penetrations. Cuts to be square and clean.

.2 Accessories: brake or bend to shape, of material and finish to match cladding, comprising of cap and ridge flashing, drip flashings, corner flashings, closure flashings at head, jamb and sills at door and window openings, roof edge and gable flashings.

.3 Soffit panels: fabricate from custom perforated sheet metal or provide purpose-made, prefabricated soffit vents acceptable to Consultant.

3.5 CAULKING AND SEALING

.1 Caulk and seal internally as specified in this Section and recommended by system manufacturer.

.2 Caulk and seal between metal siding and adjacent or abutting surfaces in accordance with Section 07 92 00 - Sealants.

3.6 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

.2 Wash down exposed surfaces using solution of mild domestic detergent in warm water, applied with soft clean wiping cloths.

.3 Remove excess sealant with recommended solvent.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 53 - Miscellaneous Rough Carpentry
.2 Section 07 21 13 - Board Insulation.
.3 Section 07 62 00 - Sheet Metal Flashing and Trim.
.4 Section 07 92 00 - Joint Sealants.
.5 Section 22 42 01 - Plumbing Specialties and Accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM C726-00a, Standard Specification for Mineral Fiber Roof Insulation Board.
  .2 ASTM C 1177/C1177M-01, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  .3 ASTM D41-94(2002)e1, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
  .4 ASTM D312-00, Asphalt Used in Roofing.
  .5 ASTM D6162-00a, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
  .6 ASTM D6163-00e1, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
  .7 ASTM D6164-00, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
.2 Canadian Standards Association (CSA):
  .1 CSA A123.23.
  .2 CSA A123.21-14 - Standard test method for the dynamic wind uplift resistance of Membrane - Roofing Systems.
.3 Factory Mutual (FM Global).
  .1 FM Approvals - Roofing Products.
  .2 FM- 4470 Wind Uplift Requirements
.4 Canadian Roofing Contractors Association (CRCA).
  .1 CRCA Roofing Specifications Manual-1997.
.5 Health Canada / Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).

1.3 PERFORMANCE REQUIREMENTS

.1 Compatibility between components of roofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.

1.4 GENERAL REQUIREMENTS FOR ROOFING SYSTEM

.1 SBS modified bituminous membrane. The system used as the Standard of Acceptance for the work consists of:
  .1 Two (2)-ply SBS modified bitumen membrane.
  .2 Protection board
  .3 Polyisocyanurate insulation
  .4 Vapor barrier
  .5 Support panels
.2 The specified roofing system is based on Soprema. Other complete and comparable membrane, insulations and vapour barrier systems will be considered if proposed and accepted as approved equals, prior to tender close.

1.5 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Submit two (2) copies of the most current technical data sheets. These documents must describe the physical properties of materials and explanations about product installation, including restrictions, limitations and other manufacturer recommendations.
.3 Indicate flashing, details.
.4 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.
.5 Manufacturer's Certificate: certify that products meet or exceed specified requirements.
.6 Manufacturer's field report: in accordance with Division 01 - General Requirements.
.7 Provide shop drawing indicating fastening pattern at field, edges, corners and around roof mounted equipment.
.8 Sub-contractor and installed certificate of approval issued by the system manufacturer.

1.6 QUALITY ASSURANCE

.1 System manufacturer to attend a minimum of three (3) site visits.
.2 Membrane: applied by sub-contractor and installer, certified by manufacturer for application of its products.

1.7 FIRE PROTECTION

.1 All materials will be delivered and stored in their original packaging, in conformance with the requirements described in the manufacturer's technical documentation.
.2 At all times, materials will be adequately protected and stored in a dry and properly ventilated area, away from any welding flame or spark, and sheltered from the elements and any harmful substances.
.3 Store adhesives and solvent-based mastics at a minimum of 5°C.
.4 Materials delivered in rolls will be carefully stored upright; flashings will be stored to avoid wrinkling, buckling, scratches or any other possible damage.
.5 Avoid gathering construction materials on the roof, which may affect the structural integrity by imposing loads exceeding what is admissible.

1.8 PROTECTION

.1 Prior to the start of work, conduct a site inspection to ensure its safety in order to minimize fire risks and hazards.
.2 Respect safety measures recommended by the related local authorities.
.3 At the end of each workday, use a heat detector gun to spot any smoldering or concealed fire. Job planning must be organized to ensure workers are still on location at least two (2) hours after welding works. An inspection must be performed by an employee of the roofing contractor who specializes in this kind of job at the end of works and, if necessary, with the help of a member of the fire protection service of the municipality.
.4 Never apply the torch directly to flammable materials.
.5 Throughout roofing installation, maintain a clean site and have a fire hose (when possible) and at least one ULC-approved Class A, B or C fire extinguisher, charged and in perfect operating condition, within 6 m (20 ft) of each torch. Respect all safety measures described in technical data sheets of sealants. Welding torches must never be placed near combustible or flammable products, nor be used where the flame is not visible or cannot be easily controlled.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Do not install roofing when temperature remains below -18ºC for torch application, or to manufacturers recommendations for mop application.
.2 Minimum temperature for solvent-based adhesive is -5ºC.
.3 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.

1.10 FULL SYSTEM WARRANTY

.1 The membrane manufacturer will issue a written document in the Owner's name, valid for a fifteen (15) year period, stating that it will repair any leaks in the roofing membrane to restore the roofing system to a dry and water tight condition, to the extent that manufacturing or installation defects caused such water infiltration. The warranty must cover all roofing components from the deck up to the finish cap sheet and the total cost of repair(s) during the entire warranty period. The warranty must be transferable, at no extra cost, to subsequent building owners. The warranty certificate must reflect these requirements.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.
.4 Place materials defined as hazardous or toxic in designated containers.

2 Products

2.1 COMPATIBILITY

.1 All roofing waterproofing materials shall be provided by the same manufacturer.

2.2 FASTENING

.1 Roof system to be mechanically fastened to meet CSA A123.21 Standards.
.2 Prior to installation manufacturer to submit their test report, with proposed products, demonstrating compliance with wind uplife resistance standard.

2.3 VAPOUR BARRIER SUPPORT PANELS

.1 Gypsum-Fibre Roof Board:
  .1 Fibre-reinforced gypsum roof board 16mm-thick.
  .2 In conformance with: CAN/ULC S102 and ASTM D3273.
  .3 Acceptable Material:
    .1 Securock Gypsum-Fibre Roof Board by CGC.

2.4 VAPOUR BARRIER

.1 Self-Adhesive Vapour Barrier
  .1 Self-adhesive membrane composed of SBS modified bitumen, with a surface screen made of high-density polyethylene laminated between two layers of polyethylene films. The width of the membrane is 1.14 m to allow the membrane to fit on the top of most structural steel deck profiles. The self-adhesive underface is protected with a silicone plastic release film. Resistance to water vapour transmission: 1.7ng/Pa.5.m² (0.03 perm).
  .2 Acceptable Material:
    .1 Sopravap'r by Soprema.
    .2 M.V.P. by IKO.
    .3 PERMATE STICK by Lexcor.

2.5 INSULATION

.1 The total system from the top of the deck to top of membrane to provide minimum R- value as noted on roof assemblies. Minimum two (2) layers with joints offset.
.2 Rigid Cellular Poly-isocyanurate, to thickness indicated.
  .1 Faced: to ASTM C 1289-98, glass fiber reinforced polyisocyanurate core, surfaced with glass fiber faces. Minimum two layers with joints staggered.

.2 Tapered insulation minimum 1% slope to drains.
.3 Insulation at roof drains is to be a minimum of R30 at square sump at roof drains.
.4 Thermal Resistance: R Value per inch = 6.0.
.5 Acceptable Material:
.1 IKO Therm Poly-Isocyanurate Insulation.
.2 Soprema, Sopra-Iso.

2.6 INSULATION SUBSTRATE OVERLAY

.1 Bituminous Board
.1 Semi-rigid roofing support panel composed of a mineral-reinforced asphaltic core between two asphalt-saturated fiberglass liners. Length of 2440 mm long x widest practical width x 4.8mm thick.
.2 Acceptable Material:
.1 Sopraboard by Soprema.
.2 Protectoboard by IKO.
.3 LEXBASE R+ by Lexcor.
.3 2-1 Soprasmart board by Soprema and ShieldBase 180 by IKO may be used in lieu of substrate overlay and base sheet membrane for field surface.

2.7 MEMBRANES

.1 Base Sheet Membrane for Field Surface
.1 Roofing membrane composed of SBS modified bitumen and a non-woven polyester reinforcement. Both sides are covered with a thermofusible plastic film. The surface must be marked with three (3) chalk lines to ensure proper roll alignment.
.2 In conformance with: CGSB 37.56-M (9th Draft).

Properties	**MD**
Strain Energy (kN/m)	9
Breaking Strength (kN/m)	17
Ultimate Elongation (%)	60
Tear Resistance (N)	60
Static Puncture Resistance (N)	400
Dimensional Stability (%)	-0.4
Plastic Flow (°C)	105 (greater than or equal)
Cold Bend at -30°C	No Cracking
Lap Joint Strength (kN/m)	Pass >4 kN/m

.3 Acceptable Materials:
.1 Sopralene Flam 180 by Soprema.
.2 Torchflex TP-180-FF by IKO.
.3 VANGUARD 180 FF by Lexcor.
.4 2-1 Soprasmart board by Soprema and ShieldBase 180 by IKO may be used in lieu of substrate overlay and base sheet membrane for field surface.

.2 Base Sheet Membrane for Flashings and Parapets
.1 Membrane composed of SBS modified bitumen and composite heavy duty reinforcement. The surface is covered with a thermofusible plastic film and the underface is covered with a release protection film. The surface shall be marked with three (3) chalk lines to ensure proper roll alignment.
.2 In conformance with: CGSB 37.56-M (9th Draft).

Properties	MD
Strain Energy (kN/m)	9
Breaking Strength (kN/m)	17
Ultimate Elongation (%)	60
Tear Resistance (N)	60
Static Puncture Resistance (N)	400
Dimensional Stability (%)	-0.4
Plastic Flow (°C)	105 (greater than or equal)
Cold Bend at -30°C	No Cracking
Lap Joint Strength (kN/m)	Pass >4 kN/m

.3 Acceptable Materials:
- .1 Sopralene Flam Stick by Soprema.
- .2 Armourbond Flash by IKO.
- .3 VANGUARD FLASH SA by Lexcor.

.3 Roofing Cap Sheet Membrane for Field Surfaces, Flashings and Parapets
- .1 Use for 15 Year Warranty.
- .2 Roofing membrane composed of SBS modified bitumen with a non-woven polyester reinforcement and elastomeric bitumen . The surface is protected by coloured granules. The underface is covered with a thermofusible plastic film.
- .3 In conformance with: CGSB 37.56-M (9th Draft).

Properties	MD
Strain Energy (kN/m)	10
Breaking Strength (kN/m)	18
Ultimate Elongation (%)	60
Tear Resistance (N)	75
Static Puncture Resistance (N)	420
Dimensional Stability (%)	0.8
Plastic Flow (°C)	105 (greater than or equal)
Cold Bend at -30°C	No Cracking
Lap Joint Strength (kN/m)	Pass >4 kN/m

.4 Acceptable Materials:
- .1 Sopralene Flam 250 GR by Soprema.
- .2 Torchflex TP-250-Cap by IKO.
- .3 VAN GUARD 250 TC by Lexcor.

.4 Starter Roll
- .1 Waterproofing membranes composed of SBS modified bitumen, covered with granules on surface, with a 100 mm (4 in) selvedge on both sides. The underface is covered with a thermofusible plastic film.
- .2 In conformance with: CGSB 37.56-M (9th Draft).

Properties	MD
Strain Energy (kN/m)	13
Breaking Strength (kN/m)	25
Ultimate Elongation (%)	66
Tear Resistance (N)	118

Properties	MD
Static Puncture Resistance (N)	432
Dimensional Stability (%)	-0.2
Plastic Flow (°C)	110 (greater than or equal)
Cold Bend at -30°C	No Cracking
Lap Joint Strength (kN/m)	Pass >4 kN/m

.3 Acceptable Materials:
.1 Starter Flam GR by Soprema.

.5 Colour for Roofing Cap Sheet Membrane Granules:
.1 For field surfaces: light gray.

2.8 ACCESSORIES MEMBRANE

.1 Cover Strip
.1 Membrane strip made of SBS modified bitumen with a composite reinforcement. Both faces are covered with a plastic thermo fusible film. The strip ensures water-tightness in the end laps.
.2 In conformance with: ASTM D6162.
.3 Acceptable Material:
.1 Sopralap by Soprema.
.2 Torchtape 180-FF by IKO.
.3 VANGUARD LAP by Lexcor.

2.9 PRIMER

.1 Primer for Thermofusible Membranes
.1 Primer made of bitumen, volatile solvents and adhesive resins. Used as primer to improve the adhesion of thermofusible waterproofing membranes.
.2 Acceptable Material:
.1 Elastocol 500 by Soprema.
.2 Mod Bit Primter by IKO.
.3 MULTIGRIP by Lexcor.
.2 Primer for Self-Adhesive Membranes
.1 Primer composed of SBS synthetic rubber, adhesive resins and VOC-free solvents. Used as primer to improve the adhesion of self-adhesive membranes.
.2 Acceptable Materials:
.1 Elastocol Stick Zero By Soprema.
.2 S.A.M. LVC Adhesive by IKO.
.3 MULTIGRIP by Lexcor.

2.10 FLAME-STOP MEMBRANE

.1 Self-adhesive membrane composed of SBS modified bitumen and a glass mat reinforcement, designed to prevent flames from penetrating into voids, cavities and openings before installing heat-welded membranes.
.2 Acceptable Materials:
.1 Sopraguard tape by Soprema.
.2 VANGUARD LAP STICK by Lexcor.

2.11 COMPLEMENTARY WATERPROOFING PRODUCTS

.1 Waterproofing Mastic
.1 Description: Multi-purpose mastic composed of SBS modified bitumen, fibres, mineral fillers and solvents.
.2 Acceptable Material:

.1 Sopramastic by Soprema.
.2 Aquabarrier mastic by IKO.
.3 LEXBOND C by Lexcor.

.2 Sealing Product
.1 Bitumen/polyurethane waterproofing mono-component resin and polyester reinforcement.
.2 Acceptable Material:
.1 Alsan Flashing and Alsan Reinforcement by Soprema.
.2 MS detail by IKO.
.3 LEXCOAT FLASH by Lexcor.

2.12 FASTENERS

.1 Corrosion resistant, with minimum plate diameter of 50 mm and screw length to suit insulation thickness +38 mm.
.2 Acceptable Material:
.1 Buildex.
.2 Dekfast.
.3 Trufast.
.4 Soprafix.
.5 LEXGRIP by Lexcor.

3 Execution

3.1 SURFACE EXAMINATION AND PREPARATION

.1 Surface examination and preparation must be completed in conformance with instructions in the membrane manufacturer's technical documentation.
.2 Before roofing work begins, the owner's representative and roofing foreman will inspect and approve deck conditions (including slopes and wood grounds) as well as flashings at parapets, roof drains, plumbing vents, ventilation outlets and other construction joints. If necessary, a non-conformity notice will be issued to the contractor so that required corrections can be carried out. The start of roofing work will be considered as acceptance of conditions for work completion.
.3 Do not begin any portion of work before surfaces are clean, smooth, dry, and free of ice and debris. Use of calcium or salt is forbidden for ice or snow removal.
.4 Be sure plumbing, carpentry and all other works have been duly completed.
.5 No materials will be installed during rain or snowfall.

3.2 METHOD OF EXECUTION

.1 Roofing work must be completed in a continuous fashion as surfaces are readied and as weather conditions allows it.
.2 It's preferable to seal all joints that are not covered by a cap sheet membrane the same day. A second cap sheet cannot be installed if any moisture is present in joints.
.3 Ensure waterproofing of roofs at all times, including protection during installation work by other trades and protection as work is completed (e.g. vents, drains, etc.).

3.3 SITE PROTECTION

.1 Protect the exposed surfaces of finished work to avoid damage during roof installation and material transportation. Install walkways made of rigid boards over installed roofing materials to enable passage of people and transport of products. Assume full responsibility for any damage.

3.4 INSTALLATION OF BOARDS WITH FACTORY LAMINATED BASE SHEET

.1 Optional installation (Contractor's option).

.2 Adhere base sheet board using adhesive applied in continuous strips spaced as per CSA-123-21 requirements.
.3 Mechanically fasten boards with screws and plates for membranes spaced as per CSA-123-21 requirements.

3.5 APPLICATION OF PRIMER

.1 Wooden, metallic, concrete and masonry surfaces or gypsum insulation substrate will receive a coat of primer at a rate recommended by the manufacturer. All surfaces to be primed must be free of rust, dust or any residue that may hinder adherence. Primed surfaces must be covered with the roofing membrane as soon as possible (on the same day for self-adhesive membranes).

3.6 INSTALLATION OF BASE SHEET FLASHING

.1 Apply base sheet flashing only, once primer coat is dry.
.2 Install base sheet flashing in one (1) meter widths to cover roofing substrate over 100mm overlap side laps by 75mm. Stagger side laps by at least 100mm from base sheet overlaps on roof to avoid excessive layering.
.3 Apply base sheet flashing directly onto substrate by removing silicone paper cover sheet. Torch roof's base-sheet plastic film on installation zone. Proceed from top to bottom. Once in place, apply pressure manually in a uniform fashion to obtain homogenous adherence over entire surface. Preferably seal seams with rubber roller.
.4 Avoid forming wrinkles, air pockets or fishmouths.

3.7 INSTALLATION OF SUPPORT PANEL AND VAPOUR BARRIER

.1 Because of the nature of this system, for this type of vapour barrier, joints can be aligned (no offset) to facilitate the installation of the reinforcing strip.
.2 Adhere the first 60 mm of the self-adhesive side laps using a membrane roller, then heat weld the last 40 mm self-adhesive, heat-welded side laps.
.3 Seal the end laps by welding a 330-mm wide protection strip centered on the joint

3.8 INSTALLATION OF INSULATION

.1 It is not required to fasten insulation boards, to achieve wind uplift performance, under mechanically fastened board with factory laminated base sheet membranes. However in order to prevent any insulation board movement, they can be fastened at a rate of one fastener per 4 sq/ft.
.2 Mechanically fasten boards with screws and plates for membranes. Mechanical fasteners must be installed in the centre of the membrane side selvedge and on board surface as per CSA A123.21-10 requirements.
.3 Surfaces must be dry and free of oil, grease, dirt and debris. The adhesive must be applied using a battery operated applicator in continuous strips of 13 to 19mm wide at time of application. Beads must be spaced CSA 123.21 requirements.

3.9 INSTALLATION OF SUPPORT PANELS

.1 Install in accordance with Manufacturer's recommendations.

3.10 INSTALLATION OF FLAME-STOP MEMBRANE

.1 Adhere the membrane directly onto an approved substrate by removing the silicone release film. Flame-stop membrane is designed to prevent flames from penetrating into voids, cavities and openings while installing heat-welded membranes.

3.11 INSTALLATION OF BASE SHEET ON THE FIELD SURFACE

.1 Unroll base sheet on the substrate, taking care to align the edge of the first selvedge with drain centre (parallel to roof edge).

.2 Cut off corners at end laps to be covered by the next roll.
.3 Weld the base sheet onto prepared substrate.
.4 Each selvedge will overlap the previous one along lines provided for this purpose, and will overlap the ends by 150 mm. Space end laps by a minimum of 300 mm.
.5 Avoid the formation of wrinkles, swellings or fishmouths.

3.12 INSTALLATION OF SELF-ADHESIVE BASE SHEET ON FLASHING AND PARAPETS

.1 Apply base sheet flashing only after primer coat is dry.
.2 Before applying membranes, always burn the plastic film from the section to be covered if there is an overlap (inside and outside corners and field surface). For sanded base sheet membranes, apply primer for self-adhesive membranes on the area to be covered at the foot of the parapets.
.3 Cut off corners at end laps of areas to be covered by the next roll.
.4 Each selvedge will overlap the previous one along lines provided for this purpose, and by 150 mm at the ends.
.5 Position the pre-cut membrane. Remove 150mm of the silicone release film to hold the membrane in place at the top of the parapet.
.6 Then, gradually peel off the remaining silicone release film, pressing down on the membrane with an aluminium applicator to ensure good adhesion. Use the aluminium applicator to ensure a perfect transition between the flashing and the field surface.
    .1 Smooth the entire membrane surface with a membrane roller for full adhesion.
.7 Install a reinforcing gusset at all inside and outside corners.
.8 Always seal overlaps at the end of the workday.
.9 Avoid the formation of wrinkles, swellings or fishmouths.

3.13 INSTALLATION OF WELDABLE BASE SHEET ON FLASHINGS AND PARAPETS

.1 Apply base sheet flashing only after primer coat is dry.
.2 Cut off corners at end laps to be covered by the next roll.
.3 Each selvedge will overlap along lines provided for this purpose, and by 150 mm at the ends.
.4 This base sheet membrane must be welded directly to the substrate, proceeding from top to bottom using a propane torch.
.5 Avoid the formation of wrinkles, swellings or fishmouths.

3.14 INSTALLATION OF THERMOFUSIBLE CAP SHEET ON FIELD SURFACE

.1 Begin with double-selvedge starter roll. If starter roll is not used, side laps covered with granules must be de-granulated by embedding granules in torch-heated bitumen over a 75 mm width.
.2 Starting at drain, unroll the membrane on the base sheet, taking care to align the edge of the first selvedge with the edge of the roof.
.3 Cut off corners at end laps at areas to be covered by the next roll.
.4 Each selvedge will overlap the previous one along lines provided for this purpose, and will overlap by 150 mm at the ends. Space end laps a minimum of 300 mm.
.5 Heat-weld cap sheet membrane with a torch on the base sheet to create a bleed out of 3 to 6 mm.
.6 During installation, be careful not to overheat the membrane or its reinforcements.
.7 Avoid the formation of wrinkles, swellings or fishmouths.
.8 Avoid walking over finished surfaces; use rigid protective walkways as needed.

3.15 INSTALLATION OF THERMOFUSIBLE CAP SHEET ON FLASHINGS AND PARAPETS

.1 This cap sheet must be installed in one-metre-wide strips.
.2 Each selvedge will overlap the previous one laterally along lines provided for this purpose, and will overlap by 150 mm the field surface. Membranes for flashings must be spaced at least 100 mm with respect to the cap sheet membranes on the field surface, to avoid areas of excessive membrane thickness.

.3 Cut off corners at end laps on areas to be covered by the next roll.
.4 Use a chalk line to draw a straight line on the field surface, 150 mm from flashings and parapets.
.5 Use a torch and round-nose trowel to embed the surface granules in the layer of hot bitumen, starting from the chalk line on the field surface to the bottom edge of the flashing or parapet, as well as on the granulated vertical surfaces to be overlapped.
.6 This cap sheet will be heat-welded directly to the base sheet membrane, proceeding from bottom to top.
.7 Avoid the formation of wrinkles, swellings or fishmouths.
.8 During installation, be careful not to overheat the membrane and its reinforcements.

3.16 INSTALLATION OF VARIOUS DETAILS

.1 Install waterproofing membranes at various roofing details in conformance with typical details indicated in technical documentation of the manufacturer.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 46 19 - Steel Siding.

1.2 REFERENCES

.1 The Aluminum Association Inc. (AA)
- .1 Aluminum Sheet Metal Work in Building Construction-2000.
- .2 AA DAF45-97, Designation System for Aluminum Finishes.

.2 American Society for Testing and Materials (ASTM International)
- .1 ASTM A167-99, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 ASTM A240/A240M-02, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .3 ASTM A591/A591M-98, Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.
- .4 ASTM A606-01, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
- .5 ASTM A653/A653M-01a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .6 ASTM A792/A792M-02, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .7 ASTM B32-00, Standard Specification for Solder Metal.
- .8 ASTM B370-98, Standard Specification for Copper Sheet and Strip for Building Construction.
- .9 ASTM D523-89(1999), Standard Test Method for Specular Gloss.
- .10 ASTM D822-01, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.3 Canadian Roofing Contractors Association (CRCA)
- .1 Roofing Specifications Manual 1997.

.4 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
- .2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .3 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.

.5 Canadian Standards Association (CSA International)
- .1 CSA A123.3-98, Asphalt Saturated Organic Roofing Felt.
- .2 CSA-A440-00/A440.1-00 - A440-00, Windows / Special Publication A440.1-00, User Selection Guide to CSA Standard A440-00, Windows.
- .3 CSA B111-1974(R1998), Wire Nails, Spikes and Staples.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.

.2 Place in appropriate on-site bins in accordance with Waste Management Plan.

.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 SHEET METAL MATERIALS

.1 Pre-Coated Galvanized Steel: ASTM A653/A653M, Z275 zinc coating designation; minimum 28 gauge core steel. Shop pre-coated with as selected coating; colour per material / finish schedule.

2.2 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.
.2 Plastic cement: to CAN/CGSB 37.5.
.3 Underlay for metal flashing: Membrane flashing by Section 07 27 00 - Air Barriers.
.4 Sealants: to CAN/;CGSB 19.13, one component.
  .1 Acceptable Material:
    .1 Tremco A Spectrum 2"
    .2 Pecora 895 NST.
.5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
.6 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
.7 Washers: of same material as sheet metal, 1 mm thick with rubber or neoprene packings.
.8 Prefabricated flashing at pipes penetrating roofs: purpose-made, neoprene or spun aluminum to CRCA Specification FL/532, minimum 300mm above top of roof membrane.
.9 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.
  .1 Brake form to profiles indicated and required to suit parapet configurations.
  .2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.
  .3 Hem exposed edges on underside 12 mm. Miter and seal corners with sealant.
  .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
  .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 METAL FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated.

3 Execution

3.1 INSTALLATION

.1 Install sheet metal work as detailed.
.2 Use concealed fastenings except where approved before installation.
.3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.
.4 Counter flash bituminous flashings at intersections of roof with vertical surfaces and curbs. Flash joints using S-lock forming tight fit over hook strips, as detailed.
.5 Lock end joints and caulk with sealant.
.6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
.7 Insert metal flashing into reglets to form weather tight junction.
.8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
.9 Caulk flashing at reglet with sealant.

.10 Install pans, where shown and around items projecting through roof membrane.

END OF SECTION

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1 General

1.1 SCOPE OF WORK

.1 Single qualified Trade to provide all firestopping for the entire project, included all mechanical & electrical penetrations, except as noted below.
.2 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Divisions 21, 22, 23, 25, 26, 27 and 28 respectively.
.3 Refer to Section 09 90 00 - Painting for painting of rated wall assemblies.
.4 Tag each type of firestopping used.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)
  .1 CAN/ULC-S115-Standard Method of Fire Tests of Firestop Systems.
  .2 NBC 3.1.9.1 Fire Stop Requirements
  .3 NBC 3.1.9.3 Fire Stop for Penetrations, Wires & Cables.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.
.2 Submit shop drawings indicating:
  .1 ULC listed firestop drawing for each anticipated distinct fire separation penetration and joint. Each ULC system firestop drawing must indicate the actual penetrating products used on site and the required fire stop materials and their proper installation.
  .2 Technical information for each material used in ULC system firestop drawing above.
  .3 Construction details should accurately reflect actual job conditions.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Division 01 - General Requirements.
.2 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.
.3 Material Safety Data Sheets:
  .1 Submit MSDS for inclusion in Operation and Maintenance Manual.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MATERIALS

.1 Use purpose designed products for application.
.2 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115.
  .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended and conforming to special requirements specified in 3.5.
  .2 All penetrations of fire separations must be fire stopped as per CAN/ULC-S115 standard with F rating and similar for Fire Resistant Rating for closures.

.3 All penetrations of a firewall must be fire stopped per CAN/ULC-S115 standard with FT rating and similar for Fire Resistant Rating for the fire separation.
.4 Acceptable Material:
.1 Tremco Fyre-Shield.
.2 A/D Fire Barrier Sealant.
.3 3M Fire Barrier Products.
.4 Hilti Firestops Products.
.5 DAP Fire Stop Fire-Rated Silicone Sealant.
.6 NUCO Inc. firestopping products.

.3 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.
.4 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.
.5 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
.6 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
.7 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
.8 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
.9 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
.10 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
.11 Sealants for vertical joints: non-sagging.
.12 At rated partitions use 1 outlet box per stud space or where more than 1 outlet box / stud spacer is required use putty pads behind or at inside face of box.
.13 Where rated assemblies are penetrated for drains use rated fire stopping.

3 Execution

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

.1 Install fire stopping and smoke seal material and components in strict accordance with ULC certification and manufacturer's written instructions.
.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
.4 Tool or trowel exposed surfaces to a neat finish.
.5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

.1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

.2 Anticipate destructive testing of 2% of firestopping at this Section's cost. Failure of 10% of tests will require replacement of all firestopping and retesting.

3.4 SCHEDULE

.1 Firestop and smoke seal at all penetrations of or joints in fire resistive wall and floor assemblies, including but not limited to:

- .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls as shown on wall schedule.
- .2 Edge of floor slabs at curtain wall and precast concrete panels.
- .3 Top of fire-resistance rated masonry and gypsum board partitions.
- .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
- .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
- .6 Penetrations through fire-resistive floor slabs, ceilings and roofs.
- .7 Outlet boxes in rated walls more than 1 box / stud space.
- .8 Openings and sleeves installed for future use through fire separations.
- .9 Around mechanical and electrical assemblies penetrating fire separations.
- .10 Rigid ducts without fire damper: greater than 129 cm2: fire stopping to consist of bead of fire sealant between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.5 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 - Cast-In-Place Concrete.
.2 Section 07 60 00 - Flashing and Sheet Metal.
.3 Section 07 84 00 - Firestopping.
.4 Section 08 80 00 - Glazing.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
  .1 ASTM C 321 - Standard Test Method for Bond Strength of Chemical- Resistant Mortars.
  .2 ASTM C 834 - Standard Specification for Latex Sealants.
  .3 ASTM C 882 - Standard Test Method for Bond Strength of Epoxy-R Systems used with Concrete by Slant Shear.
  .4 ASTM C 919 - Standard Specification for use of Sealants in Acoustical Applications.
  .5 ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
  .6 ASTM C 1330 - Standard Specification for Cylindrical Sealant Backing for use with Cold Liquid Applied Sealants.
  .7 Sealants and associated materials must conform with the latest version of standards and specifications referenced.
.2 Transport Canada (TC)
  .1 Transportation of Dangerous Goods Act (TDGA).
.3 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-19.21, Sealing and Bedding Compound Acoustical.
.4 Department of Justice Canada (Jus)
  .1 Canadian Environmental Protection Act, 1999 (CEPA).
.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Submit product data in accordance with Division 01 - General Requirements.
  .1 Caulking Compound.
  .2 Primers.
  .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
  .4 Installation instructions, surface preparation and product limitations.
.2 Manufacturer's Technical Data Guides and application procedures.
.3 Submit cured samples illustrating colors selected.
.4 Submit laboratory tests or data validating product compliance with performance criteria specified. Include SWRI validation certificate where required.
.5 Upon completion of the project the sealant applicator must submit copies of the Manufacturer's Weatherseal and the Warranty Applicator's Workmanship Warranty.
.6 Before proceeding with work or ordering of material submit the following to the Consultant for review and acceptance:
  .1 Manufacturer's product data for sealants to be used.
  .2 Manufacturer's recommended installation procedures.
.7 Material Safety Data Sheets:
  .1 Submit MSDS for inclusion in Operation and Maintenance Manual.

1.4 QUALITY ASSURANCE/MOCK-UP

.1 Construct mock-up in accordance with Division 01 - General Requirements.

.2 Manufacturer Qualifications: Company regularly engaged in manufacturing and marketing of products specified in this section.

.3 Installer Qualifications: Qualified to perform work specified by reason of experience or training provided by the product manufacturer.

.4 Installer must submit a reference list including a minimum of three projects of similar size and scope.

.5 Mock-ups: Include a minimum of 3m of sealant to show compatibility with substrate, proper adhesion to substrate and chosen color.

.1 Apply mock-up with specified joint filler types and with other components noted. Installer must provide both primed and un-primed mock up to assess whether a primer is required for the project.

.2 Locate where directed by Consultant.

.3 Mock-up may remain as part of the work if acceptable to Consultant.

.4 Allow 24 hours for inspection of mock-up by Consultant before proceeding with sealant work.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.

.6 Adhesion pull tests: the number of adhesion pull tests is to be determined by the manufacturer's weatherseal warranty. Adhesion pull tests are to be conducted by or in the presence of the manufacturer's representative. The manufacturer is to supply the Consultant / Owner with the results of the adhesion pull tests. The sealant installer is responsible for repairing areas where adhesion pull tests are conducted.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Division 01 - General Requirements.

.2 Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Material Safety Data Sheets (MSDS) for each product.

.3 Store products in location protected from freezing, damage, construction activity, precipitation and direct sunlight in strict accordance with manufacturer's recommendations.

.4 Condition products to approximately 16 to 21 degrees C, for use in accordance with manufacturer's recommendations.

.5 Handle all product with appropriate precautions and care as stated on Material Safety Data Sheet (MSDS).

1.6 PROJECT CONDITIONS

.1 Do not use products under conditions of precipitation or freezing weather. Use appropriate measures for protection and supplementary heating to ensure proper curing conditions in accordance with manufacturer's recommendations if application during inclement weather occurs.

.2 Ensure substrate is dry.

.3 Protect adjacent work from contamination due to mixing, handling and application.

.4 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.5 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

1.8 WARRANTY

.1 Provide manufacturer's five (5) year standard material warranty.
.2 Include coverage for replacement of sealant materials which fail to achieve water tight seal, exhibit loss of adhesion or cohesion, or do not cure.
.3 Warranty Exclusions: Failure resulting from concrete shrinkage, structural cracks or defects, faulty construction, faulty design, faulty materials (other than sealant), misuse of structure, settlement or accident, fire or other casualty, or physical damage.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.
.4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Provincial and Municipal regulations.

2 Products

2.1 MANUFACTURERS

.1 Acceptable material:
  .1 BASF Building Systems.
  .2 Pecora Corporation.
  .3 Tremco Sealant and Waterproofing.
  .4 Sika Canada Inc.
  .5 Dow Corning.
.2 Provide all joint materials of the same type form a single manufacturer.

2.2 MATERIALS

.1 Single Component, Non-Sag Polyurethane Sealant with plus or minus 25 percent movement capability for vertical joints; ASTM C 920, Type S, Grade NS, Class 35, uses NT, M, A, O & I.
  .1 Acceptable Materials:
    .1 MasterSeal NP1 by BASF Building Systems.
    .2 Pecora DynaTrol 1-XL by Pecora Corporation.
    .3 Sikaflex 1a by Sika Canada Inc.
  .2 [Substrates: concrete, masonry, aluminum, wood, copper, stainless steel, galvanized steel and some stone. Expected service life: 7 - 12 years. Possible uses: Wall joints, window frames, precast joints, parapets etc.]
.2 Multi-component, Polyurethane Sealant with plus or minus 50 percent joint movement capability; ASTM C 920, Type M, Grade NS, Class 25, uses NT, T, M, A, O, G and I; UL classified (fire resistance).
  .1 Acceptable Materials:
    .1 DynaTrol II by Pecora Corporation.
    .2 MasterSeal NP2 by BASF Building Systems.
    .3 Dymeric 240 by Tremco Sealant & Waterproofing.
    .4 Sikaflex 2C NS by Sika Canada Inc.
  .2 [Substrates: concrete, masonry, aluminum, vinyl siding, copper, stainless steel, galvanized steel, marble, granite and limestone. Expected service life: 7 - 12 years. Possible uses: Wall joints, window frames, structural components, etc.]
.3 Single component neutral cure silicone sealant for non-structural glazing applications with plus / minus 50 percent joint movement capability; ASTM C 920, Type S, Grade NS, Class 50, Use NT, M, G and A.
  .1 Acceptable Materials:
    .1 Pecora 864NST or 895NST by Pecora Corporation.

.2 Dow Corning 795 by Dow Corning.
.3 Spectrum 2 by Tremco Sealant & Waterproofing.

.2 [Substrates: concrete, masonry, aluminum, glass & plastics. Expected service life: 20 years +. Possible uses: conventional glazing, window & door frames, window perimeters, curtain walls, expansion & control joints etc.

.4 Single component neutral cure silicone sealant for non-structural glazing applications with plus 100% minus 50% joint movement capability; ASTM C 920, Type S, Grade NS, Class 100/50, use T, NT, M, G, A and O. SWRI validated.

.1 Acceptable Materials:
.1 Pecora 890NST by Pecora Corporation.
.2 Spectrum 1 by Tremco Sealant & Waterproofing.
.3 Dow Corning 790 by Dow Corning.

.2 [Substrates: concrete, masonry, stone, ceramics, granite, wood, steel, aluminum and plastics. Expected service life: 20 years +. Possible uses: precast panels, curtain walls, mullions, expansion joints, EIFS, etc.

.5 Single component mildew resistant silicone sealant plus/minus 25% movement capability; ASTM C 920, Type S, Grade NS, Class 25, Use NT, G and A.

.1 Acceptable Materials:
.1 Pecora 898 by Pecora Corporation.
.2 Tremsil 200 by Tremco Sealant & Waterproofing.
.3 Dow Corning 786.

.2 [Substrates: glass, aluminum, tile and fiberglass. Possible uses: countertops, kitchen & bath areas, non-structural glazing, etc.

.6 Single component synthetic rubber sealant purpose made for use in acoustical applications.

.1 Acceptable Materials:
.1 Tremco Acoustical Sealant.
.2 Pecora BA-98.

2.3 ACCESSORIES

.1 Primer: Type recommended by the sealant manufacturer and compatible with joint forming materials.

.2 Joint Cleaner: Non-corrosive and non-staining type recommended by sealant manufacturer and compatible with joint forming materials.

.3 Soft Backer Rod: non-gassing, reticulated closed-cell polyethylene rod designed for use with cold-applied joint sealants.

.1 Comply with ASTM C 1330.
.2 Size required for joint design.

.4 Closed-Cell Backer Rod: closed-cell polyethylene rod designed for use with cold-applied joint sealants for on-grade or below-grade applications.

.1 Comply with ASTM C 1330.
.2 Size required for joint design.

.5 Joint Filler: closed-cell polyethylene joint filler, designed for use in cold joints, construction joints or isolation joints wider than 1/4 inch (6mm).

.1 Size required for joint design.

.6 Bond Breaker: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

2.4 COLOR

.1 Sealant Colors: Selected by Consultant.

.1 Manufacturer's standard color range.
.2 Custom color matching submittal of job site substrate samples.

3 Execution

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 EXAMINATION

.1 Inspect all areas involved in work to establish extent of work, access and need for protection of surrounding construction.
.2 Conduct pre-application inspection of site verification with an authorized manufacturer's representative.
.3 Occupied areas: where high VOC materials are utilized, investigate occupants to determine the measures to be taken to accommodate them.

3.3 PREPARATION

.1 Remove loose materials and foreign matter which could impair adhesion of the sealant.
.2 Clean joint and saw cuts by grinding, sandblasting or wire brushing to expose a sound surface free of contamination and laitance.
.3 Ensure structurally sound surfaces are dry, clean, free of dirt, moisture, loose particles, oil, grease, asphalt, tar, paint, wax, rust, waterproofing, curing and parting compounds, membrane materials and other foreign matter.
.4 Where the possibility of sealants staining adjacent areas or materials exist, mask joints prior to application.
    .1 Do not remove masking tape before joints have been tooled and initial cure of joint filler has taken place.
    .2 Work stained due to failure of proper masking precautions will not be accepted.

3.4 INSTALLATION:

.1 Priming:
    .1 Prime all surfaces to receive sealant with recommended primer unless the mockup proves otherwise.
.2 Back-Up Material:
    .1 Install appropriate size backer rod, larger than joint where necessary according to manufacturer's recommendations.
    .2 Install polyethylene joint filler in joints wider than 1/4 inch (6mm) to back-up material per manufacturer's recommendations.
.3 Bond Breaker:
    .1 Install bond-breaker strip in joint to be sealed on top of back-up material to prevent adhesion of sealant to back-up material; install per manufacturer's recommendations.
.4 Sealant:
    .1 Prepare sealants that require mixing; follow manufacturer's recommended procedures, mixing thoroughly.
    .2 Mix only as much material as can be applied within manufacturer's recommended procedures, mixing thoroughly.
    .3 Apply materials in accordance with manufacturer's recommendations; take care to produce beads of proper width and depth, tool as recommended by manufacturer and immediately remove surplus sealant.
    .4 Apply materials only within manufacturer's specified application life period. Discard sealant after application life is expired or if prescribed application period has elapsed.

3.5 CLEANING

.1 Remove uncured sealant with Reducer 990, xylene, toluene or MEK. Remove cured sealant by razor, scraping or mechanically.

.2 Remove all debris related to application of sealants from job site in accordance with all applicable regulations for hazardous waste disposal.

3.6 APPLICATION

.1 Sealant.
- .1 Apply sealant in accordance with manufacturer's written instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.

.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 Cleanup.
- .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.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 92 00 - Joint Sealants.
.2 Section 08 14 16 - Flush Wood Doors.
.3 Section 08 71 00 - Door Hardware.
.4 Section 08 80 00 - Glazing.
.5 Section 09 22 16 - Non-Structural Metal Framing.
.6 Section 09 91 00 - Painting.
.7 Division 23 - Mechanical.
.8 Division 26 - Electrical: Wiring for electronic hardware.

1.2 REFERENCES

.1 Canadian Standards Association (CSA).
  .1 CSA A101-M1983, Thermal Insulation, Mineral Fibre, for Buildings.
  .2 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding).
  .3 CSA-A440.S1, Canadian Supplement.
  .4 AAMA/WDMA/CSA 101/I.S.2/A-440.
.2 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB-1.181-92, Ready-Mixed Organic Zinc-Rich Coating.
  .2 CGSB 51-GP-21M-78, Thermal Insulation, Urethane and Isocyanurate, Unfaced.
  .3 CGSB 41-GP-19M, Rigid Vinyl Extrusions for Windows and Doors.
  .4 CAN/CGSB-82.5-M88, Insulated Steel Doors.
  .5 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
  .6 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
  .7 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.
  .8 CAN4-S106-M80, Standard Method for Fire Test of Window and Glass Block Assemblies.
  .9 CAN/ULC-S702-97, Standard for Mineral Fibre Thermal Insulation for Buildings.
.3 American Society for Testing and Materials (ASTM).
  .1 ASTM A 525M-91b, General Requirements for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process Metric.
  .2 ASTM A 526M-90, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
  .3 ASTM A 527M-90, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality.
  .4 ASTM A568M-07, Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
  .5 ASTM A924M-07, Specification for General Requirements for Steel Sheet, Metallic-Coated by Hot-Dip Process.
  .6 ASTM C177-04, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
  .7 ASTM C518-04, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  .8 ASTM C578-07, Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  .9 ASTM C665-06, Specification for Mineral Fiber Insulation.
  .10 ASTM C1289-07, Specification for faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
  .11 ASTM D1622-03, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

.12 ASTM E90-04, Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
.13 ASTM E413-04, Classification for Rating Sound Insulation.
.14 ASTM C305-06 - Practice for Mechanical Mixing of Hydraulic Cement Paste and Mortars of Plastic Consistency.
.15 ASTM C1107-07a - Standard Specification for Packaged Dry Hydraulic Cement Grout (Nonshrink).

.4 Underwriters' Laboratories of Canada (ULC).
.1 CAN4-S104M-M80, Fire Tests of Door Assemblies.
.2 CAN4-S105M-M85, Fire Door Frames.
.3 CAN/ULC-S702-97 - Standard for Mineral Fibre Thermal Insulation for Buildings.

.5 CAN/ULC-S702-97 - Standard for Mineral Fibre Thermal Insulation for Buildings.
.1 CSDMA, Commercial Steel Doors and Frames, 2006.
.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990.

.6 National Fire Protection Association (NFPA).
.1 NFPA 252-08, Standard for Fire Tests of Door Assemblies.
.2 NFPA 257-07, Standard for Fire Tests of Window Assemblies and Glass Block Assemblies.
.3 NFPA 80-1999, Standard for Fire Doors and Fire Windows.
.4 UL List of Equipment and Materials, Volume 2.
.5 WH Certification Listings.

.7 ANSI:
.1 ANSI A115-05, Hardware Preparations for Steel Doors and Frames.
.2 ANSI A115-IG 94, Installation Guide for Doors and Hardware.
.3 ANSI A224.1-94, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
.4 ANSI A250.4-01, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.

1.3 DESIGN REQUIREMENTS

.1 Design exterior frame assembly to accommodate expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
.3 Labeled Fire-Rated Doors and Frames:
.1 Fire rated steel doors and frame products shall be provided for those openings as scheduled.
.2 Products shall bear the label of a recognized testing agency having factory inspection service, and shall be constructed as listed or classified for labeling.
.3 Doors provided for openings requiring fire rating only, or fire and temperature rise rating shall be tested in accordance with CAN4-S104.
.4 Frames, transom and sidelight assemblies provided for openings requiring fire rating, shall be tested in accordance with CAN4-S104.
.5 Window frames provided for openings requiring fire rating, shall be tested in accordance with CAN4-S106.
.6 Labeling shall be in accordance with ANSI/NFPA 80, the listing organization's policies and Follow-Up Service Procedures/Manuals.
.7 Fire rated door or frame component, not qualifying for labeling due to design, hardware or any other reason, shall be noted in the submittal documents, or prior to manufacture of product if hardware, glazing or other options affecting fire-rating are not available at time of submittal shop drawing preparation.
.4 Ensure core materials for exterior doors attains thermal resistance of R 5 when tested in accordance with ASTM C177 or ASTM C518.

.5 Product quality shall meet standards set by (CSDMA) Canadian Steel Door and Frame Manufacturers Association.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.
.2 Product Data:
  .1 Submit manufacturer's product specification, construction details, material, finish descriptions and dimensions of individual components.
  .2 Submit manufacturer's literature, data sheets for each type of material provided under this Section for project.
  .3 Data sheets shall provide all required information.
  .4 Submit required copies of detailed instructions for inclusion in maintenance manual.
  .5 Submit manufacturer's installation instructions.
.3 Material Safety Data Sheets:
  .1 Submit MSDS for inclusion in Operation and Maintenance Manual.
.4 Shop Drawings:
  .1 Show each type of frame, door, core, metal thicknesses and finishes, openings (glazed and/or louvered), fire ratings, location of exposed fasteners, cutouts, hardware blanking, reinforcing, tapping and drilling arrangements.
  .2 Show large scale frame sections and anchoring details.
  .3 Submit door and frame schedule identifying each unit.
  .4 Ensure each unit bears legible identifying mark corresponding to that listed in Door and Frame Schedule.
  .5 Fabrication shall not proceed without receipt of reviewed submittal drawings and reviewed hardware schedule.
.5 Test Reports:
  .1 Submit following test reports:
    .1 Steel door and frame assemblies supplied under this Section meet acceptance criteria of ANSI A224.1 and ANSI A250.4, Level "A".
    .2 Insulated door cores supplied in exterior doors under this Section meet specified thermal resistance rating.
    .3 Thermally broken frames meet or exceed CAN/CGSB-82.5-M.
    .4 Submit in addition to fire label, certificate to substantiate design and construction of firerated screen assemblies, if required by Consultant or authorities having jurisdiction.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M and NFPA 252 for ratings specified or indicated.
.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled.
.3 Test products in strict conformance with CAN4-S104, ASTM E 152 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.6 QUALITY ASSURANCE MOCK-UP

.1 Fabricate a mock-up that will demonstrate the various aspects of the air barrier / door connection / cladding (brick, steel, wood, EIFS and/or vinyl) installation and detailing.
.2 The installation is to reflect the intent to have a full tie in of the air barrier to the entire perimeter of all wall openings, including windows, doors and louvers, providing a tight air and water seal and the relationship of the cladding installation to the openings.

.3 The mock-up is to be reviewed by the Contractor, Membrane Installer, Frame Installer, Owner and Consultant prior to the Contractor moving forward with the installation of all other windows.
.4 Allow 48 hours to convene the review on site.
.5 Mock-up to be approved prior to fabrication of additional openings.
.6 Openings installed prior to review and approval will be removed at the Contractors expense and rebuilt.
.7 The approved mock-up may remain on site as part of the work and it will form the standard of acceptance for the remainder of the work.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Be responsible for supply of products under this Section to site in timely manner, so as not to delay progress of other trades.
.2 Protect doors and frames during shipping and storage.
.3 Inspect all materials thoroughly upon receipt and report all discrepancies, deficiencies and/or damages immediately in writing to the Supplier. Note all damage on carrier's Bill of Lading.
.4 Make good immediately any damage done. Clean scratches and touch up with rust-inhibitive primer. Replace damaged work which cannot be repaired, restored or cleaned.
.5 Store in a dry, secure location, on planks or dunnage. Doors and frame shall be stored in a vertical position, spaced with blocking. Materials shall be covered to protect them from damage but is such a manner as to permit air circulation. Site storage and protection of materials shall be in accordance with NAAMM-HMMA 840.

1.8 OPENING SIZES

.1 Method of measuring sizes:
  .1 Width - Width of openings shall be measured from inside to inside of frame jamb rabbets.
  .2 Height - Heights of openings shall be measured from the level finished floor (exclusive of floor coverings to the head rabbet of the frame.
  .3 Door sizes - Doors shall be sized so as to fit the above openings and allow 3 mm maximum clearance at jambs and head of frame. A clearance of 6 mm maximum shall be allowed between the bottom of the door and the finished floor (exclusive of floor coverings). These are considered to be nominal clearances, subject to ordinary commercial variations.

1.9 WARRANTY

.1 Warrant work of this Section for period of 1 year against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; buckling, opening of seams, bond failure and extensive colour fading.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 ACCEPTABLE MATERIALS

.1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
- .1 Ambico Limited; www.ambico.com
- .2 Apex Industries; www.apexindustries.com
- .3 Daybar Industries Limited; www.daybar.com
- .4 Fleming Door Products Limited; www.flemingdoor.com

2.2 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A 526M or ASTM A 527M coating designation to ASTM A 525M, ZF75, minimum base steel thickness in accordance with CSDFMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CAN/CSA-G40.21, Type 44W, coating designation to ASTM A 525M, ZF75.

2.3 DOORS: CORE MATERIALS

.1 Honeycomb construction:
- .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m3 minimum sanded to required thickness.

.2 Polystyrene Core:
- .1 ASTM C578, Type 1, rigid extruded fire retardant, closed cell board, density 16 to 32 kg/cu m, thermal values R-6.0 minimum. All exterior doors.

.3 Stiffened: face sheets welded, honeycomb, insulated core.
- .1 Fibreglass: to CSA A101, semi-rigid Type 1A density 24 kg/m3.

2.4 DOORS: CONSTRUCTION

.1 Form each face sheet for exterior doors from 18 ga sheet steel.

.2 Form each face sheet for interior doors from 18 ga sheet steel.

2.5 DOORS: FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: hollow steel styrene insulated construction. Interior doors: honeycomb construction.

.3 Fabricate doors with longitudinal edges tack welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.5 Reinforce doors where required, for surface mounted hardware. Provide flush vinyl top caps to exterior doors.

.6 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104, ASTM E 152 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.7 Manufacturer's nameplates on doors are not permitted.

.8 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

2.6 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
.2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
.3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.7 PRIMERS

.1 Touch-up prime CAN/CGSB-1.181.

2.8 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.
.2 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
.3 Metallic paste filler: to manufacturer's standard.
.4 Sealant: Refer to Section 07 92 00 - Joint Sealants.
.5 Door bottom seal: Refer to Section 08 71 00 - Door Hardware.
.6 Glazing: Refer to Section 08 80 00 - Glazing
.7 Fire labels: metal riveted.
.8 Make provisions for glazing as indicated and provide necessary glazing stops.
    .1 Provide removable steel glazing beads for use with glazing tapes and compounds and secured with countersunk steel screws.
    .2 Design exterior glazing stops to be tamper proof.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.
.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
.5 Securely attach floor anchors to inside of each jamb profile.
.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.
.7 When required due to site access or due to shipping limitations, frame products for large openings shall be fabricated in sections, with splice joints for field assembly by others.

2.10 FRAMES: SIDELITES AND SCREENS FABRICATION GENERAL

.1 Fire-Rated Frames: Fabricate fire-rated frames in accordance with underwriter's requirements using material not less than the thickness specified herein unless a greater thickness is stipulated by the labelling authority.
.2 Fabricate frames in accordance with CSDMA specifications.
.3 Fabricate frames to profiles and maximum face sizes and indicated.
.4 Exterior Frames: 1.5 mm wiped zinc finish steel, welded thermally broken type construction.
.5 Interior frames: 1.5 mm welded type construction.
.6 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier.
.7 Protect mortised cut outs with steel guard boxes.
.8 Manufacturer's nameplates on frames and screens are not permitted.
.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
.10 Insulate exterior frame components with polyurethane insulation.
.11 Cut mitres and joints accurately and weld continuously all joints and seams on the inside of frame profile.

.12 Grind welded corners and joints of flat plane, fill with metallic paste filler and sand to uniform smooth finish.
.13 Stiffen frames over 1200mm unsupported width with minimum 1.2mm formed steel channel, funnel thickness and width of frame, welded into head profile.
.14 Install 2 bumpers on strike jamb for each single door and 2 bumpers at head for pair of doors.
.15 Provide 2 spreader bars per door frame of 1.5mm materials. Welded at base of frame to ensure alignment during shipment.
.16 Borrowed light and screens size as noted on drawings, with removable stop for glazing of frame, on inside room side.

2.11 FRAMES: EXTERIOR THERMALLY BROKEN

.1 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
.2 Thermal break: rigid polyvinyl chloride extrusion conforming to CGSB 41-GP-19Ma.

2.12 FRAME AND SCREEN ANCHORAGE

.1 Frame Anchors:
  .1 Frame anchor shall be provided with anchorage appropriate wall and frame construction.
.2 Floor Anchors:
  .1 Where frame is installed prior to construction of adjacent wall, each jamb shall be provided with 1.52 mm (16 ga) steel floor anchors.
  .2 Each anchor shall be provided with 2 (two) holes for mounting to floor and shall be securely welded to inside of jamb profile.
.3 Wall Anchors:
  .1 Each wall anchor shall be located immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
  .2 Provide 2 anchors for rebate opening heights up to and including 1500 mm and one (1) additional anchor for each additional 760 mm of height or fraction thereof, except as indicated below.
  .3 For frames in previously placed concrete, masonry or structural steel provide anchors located not more than 150 mm from top and bottom of each jamb and intermediate anchors at 660 mm on center maximum.
  .4 Frame installed in steel stud and drywall partitions shall be provided with 20 gauge steel snap-in or "Z" stud type anchors.
  .5 Supply frame anchors to gypsum board installers with directions for installing steel door frames in solid gypsum board partitions.
  .6 Frame for installation in new masonry walls shall be provided with steel adjustable wall anchors of the T-strap, stirrup or wire, 16 gauge minimum or 0.156 in. diameter wire.
    .1 Straps shall be not less than 50mm x 254mm in size, corrugated and/or perforated.
  .7 Jambs of frames in previously placed concrete, masonry or structural steel shall be punched and dimpled to accept machine bolt anchors, 6.4mm diameter, located not more than 150mm from the top and bottom of each jamb.
  .8 Anchor preparations and guides shall also be located immediately above or below the intermediate hinge reinforcing and directly opposite on the strike jamb.
  .9 Each preparation shall be provided with 16 gauge anchor bolt guides.
  .10 On sidelights or windows exceeding 3m in width, installed in stud partitions, channel extensions shall be provided from the top of the frame assembly to the underside of the structure above.
  .11 Extensions shall be fabricated from 2.66 mm (12 ga) steel formed channels, mounting angles and adjusting brackets, with mounting angles welded to the inside of frame head.

.12 Formed adjusting brackets and fasteners shall be shipped loose.
.13 Channels shall be mechanically connected to mounting angles and adjusting brackets with supplied fasteners, on site, by Subcontractor responsible for installation.

.4 Fire Rated Door and Frame Assemblies:
.1 Conform to CAN4-S104-M, CAN4-S105-M, NFPA 80 and NFPA 252.

2.13 HARDWARE PREPARATION

.1 Doors and frames shall be prepared to receive hardware.
.2 Unless otherwise shown on the drawings, locate hardware in accordance with the Recommended Locations For Architectural Hardware as published by the Door and Hardware Institute.
.3 Prepare doors and frames to receive electrified hardware.
.4 Frame preparation shall include the application of shallow back boxes suitable for EMT termination at all device locations.
.5 Back boxes shall be of sufficient size allowing for wiring, connectors, and the device to be properly installed in the mortise.
.6 Door preparation shall include the installation of conduit or suitable wire raceway within door assemblies during fabrication.

2.14 FABRICATION

.1 Permit access by an approved inspection and testing company for purpose of inspecting at random doors under fabrication.
.2 Welding: CSA W59-M.
.3 Grind exposed welds smooth and flush. Fill open joints, seams and depressions with filler or by continuous brazing or welding. Grind smooth to true sharp arises and profiles and sand down to smooth, true, uniform finish.
.4 Hardware Requirements and Preparations:
.1 Door and frame shall be blanked, reinforced, drilled and tapped at factory for fully templated hardware only in accordance with approved hardware schedule and templates provided by hardware Supplier.
.2 Check hardware list for requirements.
.3 Door and frame shall be blanked and reinforced only for mortised hardware that is not fully templated.
.4 Where surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges or non templated hardware apply, frame shall be reinforced only, with drilling and tapping done by others in field.
.5 Templated holes 12.7mm diameter and larger shall be factory prepared except mounting and through bolts holes which shall by Subcontractor responsible for installation on site, at time of application.
.6 Templated holes less than 12.7mm diameter shall be factory prepared only when required for function of device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.
.7 Hinge reinforcing shall be 3.42 mm (10 ga) steel minimum, high frequency type be provided.
.8 Reinforcing for continuous hinges shall be 2.66 mm (12 ga) minimum.
.9 Cylindrical lock, ASA strike and flush bolt reinforcing shall be 2.66 mm (12 ga) steel minimum.
.10 Mortise lock and surface mounted hardware reinforcing shall be 1.52 mm (16 ga) steel minimum.
.11 In masonry or concrete partitions with 0.76 mm (22 ga) steel grout guards. Where electrified hardware is specified on approved Hardware Schedule, steel door and frame shall have CSA approved system consisting of CSA approved conduit and junction boxes.

.12 Refer to Section 08 71 00 -Door Hardware for openings that require electrified hardware unless indicated otherwise.

.5 Frames - General:
- .1 Fabricate frames for doors, screens and borrowed lights to profiles indicated.
- .2 Reinforce frame as required for surface mounted hardware.
- .3 For door frames wider than 1500 mm, reinforce door frame head and jamb and mullions at junction of head.
- .4 Prepare each door opening for single stud door silencers: 3 for single door openings placed opposite hinges: 2 for double door openings approximately 150 mm each side of centreline of head stop.

2.15 ACCEPTABLE MATERIALS - GROUT

.1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
- .1 ChemRex Inc.; www.chemrex.com
- .2 CPD Construction Products; www.cpd.ca
- .3 Euclid Admixture Canada Inc.; www.euclidchemical.com
- .4 Sika Canada Inc.; www.sikacanada.com
- .5 W.R. Meadows of Canada; www.wrmeadows.com

.2 Spot Grout:
- .1 Proportion when used at metal door frames; 1 part hardwall plaster to not more than 2- 1/2 parts Perlite by weight, with enough water added for `hand pack' consistency.
- .2 Acceptable Materials:
  - .1 Gyproc 90 by Georgia-Pacific Canada, Inc.
  - .2 Durabond 90 by CGC Inc.

.3 Continuous Grout:
- .1 Non-shrink, non-metallic, cementitious grout, containing no chlorides, conforming to ASTM C1107 for Grade C type grouts.
- .2 Acceptable Materials:
  - .1 "Sika Grout 212" by Sika Canada Inc.
  - .2 "CG-86 Construction Grout" by W.R. Meadows of Canada Ltd.
  - .3 "Set Grout" by ChemRex Inc.

.4 Batt Insulation:
- .1 Preformed gall fibre or rockwool batt or roll insulation, conforming to CAN/ULC-S702.
- .2 Acceptable Materials:
  - .1 "QuietZone Acoustical Batts" by Owens Corning Canada Inc.
  - .2 "Roxul AFB - Acoustical Fire Batts" by Roxul Inc.
  - .3 Of type, minimum thickness, width to suit metal framing spacing and other miscellaneous spacings as indicated on Drawings.

.5 Threshold Sealant:
- .1 As recommended by installer in accordance with Section 07 92 00 - Joint Sealants.

3 Execution

3.1 INSTALLATION GENERAL

.1 Install labeled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.2 FRAME INSTALLATION - GENERAL

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width.

.4 Provide vertical support at center of head for openings over 1200 mm wide.

.5 Provide vertical support at center of head for openings over 1200 mm wide.
.6 Remove temporary spreaders after frames are built-in.
.7 Caulk perimeter of frames between frame and adjacent material.
.8 Maintain continuity of vapour barrier and air barrier.

3.3 DOOR INSTALLATION - GENERAL

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
  .1 Hinge side: 1.0 mm.
  .2 Latch side and head: 1.5 mm.
  .3 Finished floor, top of carpet: 13 mm.
.3 Adjust operable parts for correct function.
.4 Install louvers.

3.4 GLAZING

.1 Install glazing for doors and in accordance with Section 08 80 00 - Glazing.

3.5 FIRE LABELED DOORS AND FRAMES

.1 Install fire labeled doors and frames in accordance with manufacturer's printed instructions and NFPA 80.
.2 Verify labeled doors and frames are placed in their designated openings.
.3 Review, inspect and certify where required by authorities having jurisdiction.

3.6 HOLLOW METAL DOORS

.1 Install hollow metal doors in accordance with manufacturer's instructions.
.2 Install in accordance with following edge clearances unless otherwise indicated:
  .1 Between doors and frames at head and jambs: 3 mm.
  .2 At door bottom: 19 mm maximum to unfinished floor, 6 mm maximum to finished floor unless indicated to be undercut.
  .3 Between meeting edges of pairs of doors: 3 mm.

3.7 HOLLOW METAL FRAMES

.1 Install hollow metal frames in accordance with manufacturer's instructions.
.2 Set frames plumb, square, level and at correct elevation, maintaining uniform door width and height.
.3 Secure anchorages and connections to adjacent construction.
.4 Brace frames rigidly in position while being built in.
.5 Provide vertical supports and horizontal spreaders to prevent deflection and warping.
.6 Allow for deflection to prevent structural loads from being transmitted to frame.
.7 Provide expanding foam insulation to completely fill pressed steel frames of exterior doors and adjacent cavities.
.8 Door Jamb Extensions:
  .1 Provide solid blocking and securement between all door frame extensions, metal stud and door frames at a minimum four locations per door jamb.

3.8 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation with zinc primer to CGSB 1-GP-181.
.2 Fill exposed frame anchors and with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 08 11 13 - Hollow Metal Doors and Frames.
.2 Section 08 71 00 - Door Hardware.
.3 Section 08 80 00 - Glazing.
.4 Section 09 91 00 - Painting.
.5 Division 23 - Mechanical Grilles.

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
  .1 Quality Standards for Architectural Woodwork 1998.
.2 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB-71.19-M88, Adhesive, Contact, Sprayable.
  .2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
.3 Canadian Standards Association (CSA International).
  .1 CSA A440.2-98, Energy Performance of Windows and Other Fenestration Systems.
  .2 CSA-A440.S1, Canadian Supplement.
  .3 AAMA/WDMA/CSA 101/I.S.2/A-440.
  .4 CSA O115-M1982(R2001), Hardwood and Decorative Plywood.
  .5 CAN/CSA O132.2 Series-90(R1998), Wood Flush Doors.
  .6 CAN/CSA-O132.5-M1992(R1998), Stile and Rail Wood Doors.
  .7 CSA Certification Program for Windows and Doors 00.
.4 American National Standards Institute (ANSI):
  .1 A208.1 - Standard for Particleboard.
  .2 (ASTM): ASTM D 1761 - Screw Withdrawal Test Method.
.5 American Society for Testing and Materials (ASTM)
  .1 ASTM D 5456 - Standard Specification for Evaluation of Structural Composite Lumber Products.
  .2 (ASTM): ASTM D 1761 - Screw Withdrawal Test Method.
  .3 ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
  .4 ASTM E413 - Classification for Rating Sound Insulation.
  .5 ASTM E 1332 - Standard Classification for Determination of Outdoor-indoor Transmission Class.
  .6 ASTM E 2235 - Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods.
.6 American Society for Testing and Materials.
  .1 ASTM E 152-81a, Methods for Fire Tests of Door Assemblies.
.7 National Fire Protection Association (NFPA).
  .1 NFPA 80-1999, Standard for Fire Doors and Fire Windows.
  .2 NFPA 252-1999, Standard Method of Fire Tests of Door Assemblies.
.8 Underwriters' Laboratories of Canada (ULC).
  .1 CAN-4S104M-80(R1985), Fire Tests of Door Assemblies.
  .2 CAN4-S105M-85 (R1992), Fire Door Frames Meeting the Performance Required by CAN4-S104.
  .3 Underwriters' Laboratories (UL): UL 10B - Standard for Fire Test of Door Assemblies;
  .4 Underwriters Laboratories (UL): UL 10C - Standard for Positive Pressure Fire Test of Door Assemblies.
  .5 Underwriters Laboratories Canada (ULC): CAN 4-S104 - Fire Test of Door Assemblies.
.9 Uniform Building Code (UBC):
  .1 UBC 7-2-1994 UBC Fire Test (Neutral Pressure).

.2 UBC 7-2-1997 UBC Fire Test (Positive Pressure).

1.3 SUBMITTALS

.1 Make submittals in accordance with Division 01 - General Requirements.
.2 Manufacturer's data sheets on each type of door, including:
  .1 Preparation instructions and recommendations.
  .2 Storage and handling requirements and recommendations.
  .3 Installation methods.
.3 Material Safety Data Sheets:
  .1 Submit MSDS for adhesives for inclusion in Operation and Maintenance Manual.
.4 Shop Drawings:
  .1 Include details of the following items on shop drawings:
  .2 Door elevations, types, all sizes and fire ratings.
  .3 Glass location, opening size, thickness, and glazing trim.
  .4 Louver locations and opening size.
  .5 Face material and grade.
  .6 Edge material and thickness.
  .7 Fire ratings and type of door cores being supplied for rated openings.
  .8 Undercuts, hardware location and machining requirements.
.5 Samples:
  .1 For factory finished doors, submit two sets of 300 x 300 mm selected veneer samples with the standard finish colors representing manufacturer's full range of available colors and finishes.
  .2 Samples shall represent the color selected on veneer typical of grain patterns and coloration for the specified species and cut selected.
  .3 Where Consultant has furnished custom color for matching, include original color sample.
  .4 For each finish product specified, submit two complete sets of color chips representing manufacturer's full range of available colors and patterns.
  .5 Certificates:
    .1 Manufacturer's certification that doors comply with specified performance and physical properties.

1.4 QUALITY ASSURANCE

.1 Wood doors shall conform to the Quality Standards for Architectural Woodwork as published by the Architectural Woodwork Manufacturers Association of Canada (AWMAC) for the grade of door specified herein.
.2 Non-Fire-Rated Doors:
  .1 Provide doors that comply with AWI Section 1300 and WDMA 1.S. 1A.
.3 Regulatory Requirements:
  .1 Provide doors that comply with NEPA 80, NFPA 252, UL 10B or UL 10C, as applicable and as acceptable to authorities having jurisdiction, and that are listed and labeled by ITS-WH or a qualified testing agency.
  .2 Notify Consultant prior to fabrication if fire doors required cannot qualify for labeling due to design size hardware or other requirement.
.4 Oversize Fire Rated Wood Doors:
  .1 Manufacturer to provide a certificate stating that the doors conform to all standard construction requirements for tested and labeled fir door assemblies except as to size.
  .2 Notify Consultant prior to fabrication if fire doors required cannot qualify for labeling due to design, size, hardware or other requirement.
.5 Single Source Responsibility:
  .1 Provide doors from a single source to ensure uniformity in quality of appearance, face veneer, finish and construction.

.6 Hardware Installation Reference Standard:
.1 Standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame manufacturer's Association (CSDFMA).

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:
.1 Store products in manufacturer's unopened packaging until ready for installation. Inspect for damage.
.2 Storage and Protection: Comply with door manufacturer's written recommendations and requirements of AWI Section 1300 G-23 and WDMA standards.
.3 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
.4 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
.5 Protect doors from scratches, handling marks and other damage. Wrap doors.
.6 Store doors away from direct sunlight.
.2 Marking and Packaging:
.1 Factory labels shall indicate door opening numbers and correspond with approved door schedule for size and door types.
.3 Maintain environmental conditions including temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits. Inspect for damage prior to installation.

1.6 WARRANTY

.1 Provide manufacturer's standard warranty against defects in materials and workmanship for the following duration:
.1 Warranty Period, Interior Doors: For the lifetime of the door.
.2 Defects include, but are not limited to, bubbling, delamination of faces or edges, warp, twist bow exceeding 6mm, and telegraphing of core.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 WOOD DOORS

.1 Ultra Heavy Duty, Anti-Warping construction for intensive use.
.2 Styles:
.1 3mm thick veneer, longitudinally laminated by hot pressing with type 1 structural glue in compliance with ASTM D5456-93 (LVL) including a 22 mm piece of hardwood, matched with faces, total width 107mm.
.3 Top and Bottom Rails:
.1 3 mm thick veneer, longitudinally laminated by hot pressing with type 1 structural glue, as per ASTM D5456-93, for total width of 85mm.
.4 Core:
.1 Solid particleboard. Density of 28-32 lbs per cubic foot. Complies with CSA-0188 and ANSI A208-1 standards (LD-1 / LD-2).
.5 Faces:

.1 Wood veneer, refer to Material / Finish Schedule.
.2 Hardboard panel, refer to Material / Finish Schedule.
.6 Lock Block: Integrated
.7 Glue: Type1 PVA Cross-link (UFF).
.8 Styles & rails: to receive one (1) coat of clear sealer.
.9 Interior use.
.10 Warranty, Lifetime
.11 Clearances:
.1 3mm top and both jambs, 19mm bottom.
.12 Acceptable Material:
.1 Baillargeon Doors 8500 [OR]
.2 Baillargeon Doors 8520-ME [20 minute fire rating]
.13 Closet Doors Only
.1 Acceptable Material:
.1 Baillargeon 8100

2.2 WOOD DOORS - 45 MINUTE FIRE RESISTANT RATING

.1 Ultra Heavy Duty, Anti-Warping construction for intensive use.
.2 Styles:
.1 Minimum 36.5mm high-density mineral and /or SCL and untreated hardwood compliant with W/H label requirements. Bonded to core.
.3 Top and Bottom Rails:
.1 Minimum 58mm high density mineral or SCL compliant with W/H label requirements.
.4 Core:
.1 Low combustible agri-fibre. Density of 34-38 lbs per cubic square foot.
.5 Faces:
.1 Wood veneer, refer to Material / Finish Schedule.
.2 Hardboard panel, refer to Material / Finish Schedule.
.6 Lock Block: Integrated
.7 Glue: Type1 PVA Cross-link (UFF).
.8 Styles & rails: Clear finish sealer BC-00-25, factory applied.
.9 Interior use.
.10 Warranty, Lifetime
.11 Clearances:
.1 3mm top and both jambs, 19mm bottom.
.12 Acceptable Material:
.1 Baillargeon Doors 8500 AF45

2.3 GLAZING

.1 Interior Glass: Refer to Section 08 80 00 - Glazing.
.2 Stops:
.1 Finish to match door colour, by Section 09 91 00 - Painting.

2.4 FABRICATION

.1 Fabricate doors and panels in accordance with CSA 0132.2 to ULC requirements where fire-rated doors are indicated.
.2 Prepare doors for glass and provide hardwood birch species glazing stops and stickings with mitred corners.
.3 Prepare doors for louvers (door grilles).
.4 Bevel vertical edges of single acting doors 3 mm on lock side.
.5 Radius vertical edges of double acting doors to be 60mm radius.
.6 Shop prepare doors for hardware installation. Templates to be supplied by Finish Hardware Supplier.
.7 Fabricate to AWMAC standards.

3 Execution

3.1 EXAMINATION

.1 Do not begin installation until adjacent construction has been properly prepared.

3.2 PREPARATION

.1 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 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.

3.4 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.
.2 Install labeled fire rated doors to NFPA 80.
.3 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series, Appendix A.
.4 Adjust hardware for correct function.
.5 Install glazing in accordance with Section 08 80 00 - Glazing.
.6 Install louvers.
.7 Secure transom and side panels by means of stops.
.8 Install all hardware in accordance with templates and manufacturer's instructions.
.9 Install all push/pull plates on doors with outer edge 75 mm from edge of door, except where glazing does not permit.
.10 Provide proper protection of all hardware items until Owner accepts project as complete.

3.5 WOOD DOORS

.1 Install in accordance with following edge clearances unless otherwise indicated:
  .1 Between doors and frames: at head and jambs: 3 mm.
  .2 At door bottom: 9 mm maximum unless doors are indicated to be undercut.
  .3 Between meeting edges of pairs of doors: 3 mm.
  .4 Cut, drill and prepare doors to template to receive hardware.

3.6 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.
.2 Adjust hardware for proper door function and latching, and for smooth operation without excessive force for excessive clearance.

3.7 UNDERCUT DOORS

.1 Provide special door undercuts if indicated on door schedule.

3.8 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
.2 Remove traces of primer, caulking; clean doors and frames.
.3 Clean glass and glazing materials with approved non-abrasive cleaner.
.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 21 16 - Gypsum Board Assemblies.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.
.2 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for cleaning and maintenance of stainless steel finishes for incorporation into manual specified in Division 01 - General Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Division 01 - General Requirements.
.2 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.
.3 Leave protective covering in place until final cleaning of building.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 ACCESS DOORS

.1 Sizes: Except as indicated otherwise, to be minimum sizes as follows:
  .1 For body entry: 600 x 600 mm.
  .2 For hand entry: 300 x 300 mm.
.2 Construction: Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180°.
.3 Materials
  .1 Tiled surfaces and other special areas: Stainless steel with brushed satin or polished finish as directed by Consultant.
  .2 Other areas: Prime coated steel.

2.2 EXCLUSIONS

.1 Lay-in tile ceilings: use unobtrusive identification locators.

3 Execution

3.1 INSTALLATION

.1 Installation:
  .1 Gypsum wallboard surfaces: to Section 09 21 16 - Gypsum Board Assemblies.

3.2 LOCATION

.1 Location: Ensure that equipment is within view and accessible for operating, inspecting, adjusting, servicing without using special tools.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 - Metal Fabrications.
.2 Section 06 10 53 - Miscellaneous Rough Carpentry
.3 Section 07 92 00 - Joint Sealants.
.4 Section 08 71 00 - Door Hardware.
.5 Section 08 80 00 - Glazing.
.6 Section 26 05 20 - Wire and Box Connectors.
.7 Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

.1 Aluminum Association (AA).
  .1 DAF 45-03, Designation System for Aluminum Finishes.
.2 American Architectural Manufacturers Association (AAMA).
  .1 AAMA 609-93, Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.
.3 American Society for Testing and Materials International, (ASTM).
  .1 ASTM E330 02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
.4 Canadian General Standards Board (CGSB).
  .1 CGSB 1.40 97, Primer, Structural Steel, Oil Alkyd Type.
  .2 CAN/CGSB 12.1 M90, Tempered or Laminated Safety Glass.
  .3 CAN/CGSB 12.20 M89. Structural Design of Glass for Buildings.
.5 Canadian Standards Association (CSA International).
  .1 CAN/CSA G40.20/G40.21 98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  .2 CAN/CSA G164 M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 SYSTEM DESCRIPTION

.1 Design Criteria.
  .1 Design frames and doors in exterior walls to:
    .1 Expansion and contraction within service temperature range of - 35 to 35 degrees C.
    .2 Limit deflection of mullions to maximum 1/175th of clear span when tested to ASTM E330 under wind load of 1.2 kpa
    .3 Movement within system.
    .4 Movement between system and perimeter framing components or substrate.
.2 Size glass thickness and glass unit dimensions to limits in accordance with CAN/CGSB-12.20.
.3 Tie in to exterior wall air barrier and vapour barrier to provide continuous air barrier and vapour retarder through door system. Primarily in line with inside pane of glass and heel bead of glazing compound.

1.4 SUBMITTALS

.1 Submit shop details and erection drawings in accordance with Division 01 - General Requirements.
.2 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and data sheets.
  .2 Submit two copies of WHMIS MSDS Material Safety Data Sheets. Indicate VOC's for caulking materials during application and curing.
.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 Manufacturer's Field Reports:
- .1 Submit two copies of manufacturers field reports.

.5 Samples:
- .1 Submit sample of each item of hardware as well as one corner sample of door and frame. Show corner detail, glazing detail and finish.
- .2 Submit one 300 x 300 mm corner sample of each type door and frame.
- .3 Submit sample showing glazing detail, reinforcement and finish.
- .4 Frame sample to show glazing stop, door stop, jointing detail, finish, and wall trim.

.6 Shop Drawings:
- .1 Each shop drawing submitted shall bear stamp and signature of qualified professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.
- .2 Indicate materials and profiles and provide full-size, scaled details of components for each type of door and frame. Indicate:
  - .1 Interior trim and exterior junctions with adjacent construction.
    - .1 Junctions between combination units.
    - .2 Elevations of units.
    - .3 Core thicknesses of components.
    - .4 Type and location of exposed finishes, method of anchorage, number of anchors, supports, reinforcement, and accessories.
    - .5 Location of caulking.
    - .6 Each type of door system including location.
    - .7 Arrangement of hardware and required clearances.
    - .8 Submit catalogue details for each type of door and frame illustrating profiles, dimensions and methods of assembly.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Division 01 - General Requirements.

1.6 QUALITY ASSURANCE

.1 Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties in accordance with Division 01 - General Requirements.

.2 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements in accordance with Division 01 - General Requirements.

.3 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 QUALITY ASSURANCE MOCK-UP

.1 Fabricate a mock-up that will demonstrate the various aspects of the air barrier / window connection / cladding (brick, steel, wood, EIFS and/or vinyl) installation and detailing.

.2 The installation is to reflect the intent to have a full tie in of the air barrier to the entire perimeter of all wall openings, including windows, doors and louvers, providing a tight air and water seal and the relationship of the cladding installation to the openings.

.3 The mock-up is to be reviewed by the Contractor, Membrane Installer, Window Installer, Owner and Consultant prior to the Contractor moving forward with the installation of all other windows.

.4 Allow 48 hours to convene the review on site.

.5 Mock-up to be approved prior to fabrication of additional openings.

.6 Openings installed prior to review and approval will be removed at the Contractors expense and rebuilt.

.7 The approved mock-up may remain on site as part of the work and it will form the standard of acceptance for the remainder of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:
- .1 Apply temporary protective coating to finished surfaces. Do not use coatings that will become hard to remove or leave residue.
- .2 Leave protective covering in place until final cleaning of building.

1.9 WARRANTY

.1 The work of this division shall be guaranteed against defects in materials and workmanship for a period of 1 year following the date of substantial completion.

1.10 MAINTENANCE DATA

.1 Provide Maintenance data for cleaning and maintenance of aluminum finishes for incorporation into maintenance manual specified in Division 01 - General Requirements.

1.11 PROTECTION

.1 Apply temporary protective coating to finished surfaces. Remove coating after erection and as indicated by Consultant. Do not use coatings that will become hard to remove or leave residue.

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MATERIALS

.1 Aluminum extrusions: Aluminum Association alloy AA6063 T6 anodizing quality.
.2 Sheet aluminum: Aluminum Association alloy AA5005 H34 anodizing quality.
.3 Steel reinforcement: to CAN/CSA G40.20/G40.21, grade 300 W.
.4 Fasteners: stainless steel.
.5 Weatherstrip:
- .1 Thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
- .2 Meeting stiles on pairs of doors shall be equipped with an adjustable astragal using wool pile with polymeric fin, replaceable plastic.

.6 Door bumpers: black neoprene.
.7 Door bottom seal: operable and automatic door seal of anodized extruded aluminum frame and vinyl weather seal, recessed in door bottom automatic retract mechanism when door is open.
.8 Isolation coating: epoxy resin solution.
.9 Glazing materials: Refer to Section 08 80 00 - Glazing.
.10 Sealants: See Section 07 92 00 - Joint Sealants.
.11 Threshold: Extruded aluminum, one piece per door opening (or pair), with ribbed surface thermally broken.
.12 Continuous Hinge.
.13 Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners.

2.2 ALUMINUM FINISHES

.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
  .1 Permanodic anodized finish.
  .2 Factory applied thermosetting fluoropolymer coating AAMA 605.2
.2 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative.
.3 Colour: Refer to Material / Finish Schedule.

2.3 ALUMINUM DOORS, NON-THERMALLY BROKEN:

.1 Standard of Acceptance:
  .1 Kawneer, 500 Standard Entrances
.2 Vertical stiles 127mm wide
.3 Top rail 127mm wide
.4 Middle rail 152mm wide
.5 Bottom rail 165mm wide
.6 Thickness 45mm
.7 Provide non - thermally broken doors for interior locations.

2.4 ALUMINUM FIRE FRAMES

.1 Fireframes Aluminum Series, complete with Pilkington Pyrostop Glass, __ minutes rated.
.2 Finish to match adjacent aluminum framing.
.3 Standard of Acceptance:
  .1 Glass: Pilkington Pyrostop, Pilkington Group and distributed by Technical Glass Products (800-426-0279), email sales@fireglass.com, www.fireglass.com.
  .2 Door System: Fireframes Aluminum Series, Technical Glass Products (800-426-0279), email sales@fireglass.com, www.fireglass.com.

2.5 SIDELIGHTS

.1 Construct sidelights of porthole extrusions with minimum wall thickness of 3 mm and top, jamb and bottom rails to match doors.
.2 Reinforce mechanically joined corners of doors to produce sturdy door unit.
.3 Glazing stops: interlocking snap in type for dry glazing. Exterior stops: tamper proof type.
.4 Provide thermally broken sections for exterior.
.5 Standard of Acceptance:
  .1 Kawneer, Trifab 451UT Framing System
.6 Frame members 50.8mm x 114.3mm
.7 Center plane glass application
.8 Provide sealant within aluminum work and between aluminum framing and adjacent construction
.9 Location: between ice sheet and viewing area

2.6 ALUMINUM FRAMES - NON THERMALLY BROKEN

.1 Construct frames of aluminum extrusions with minimum wall thickness of 4.8 mm.
.2 Frame members 44.5mm x 101.6mm.
.3 Acceptable Material:
  .1 Kawneer, Trifab 400

2.7 STEEL FINISHES

.1 Finish steel clips and reinforcing steel with zinc coating to CSA G164.

2.8 HARDWARE

.1 Refer to Section 08 71 00 - Door Hardware.

.2 Door Signs:
- .1 Sign Material: Self adhesive type for mounting on glass.
- .2 Provide "AUTOMATIC-CAUTION-DOOR" and "ATTENTION! PORTE AUTOMATIQUE" sign on both sides of power operated swing doors serving two-way traffic. Yellow circle with black letters except the word "CAUTION" to be yellow letters on black background. Design and mounting location to CAN/CGSB-69.26-96. At each door with power operator.
- .3 Provide international pictogram sign for disabled persons on door leaf.

2.9 GLAZING

.1 Refer to Section 08 80 00 - Glazing for exterior glazing requirements.

2.10 FABRICATION GENERAL

- .1 Doors and framing to be by same manufacturer.
- .2 Fabricate doors and frames to profiles and maximum face sizes as shown. Provide minimum 25 mm bite for insulating glazed units.
- .3 Provide structural steel reinforcement as required for adequate strength, stiffness and connections.
- .4 Accurately fit intersecting members to flush hairline, weathertight joints and mechanically interlock together.
- .5 Conceal fastenings.
- .6 Accurately form cut-outs, recesses, mortising or milling required for finishing hardware in accordance with templates supplied and adequately reinforce with aluminum or galvanized steel plates.
- .7 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.
- .8 Provide weatherstripping of a type which will permit replacement without special tools.
- .9 Construct doors to sizes indicated on schedule, using porthole extrusions.
- .10 Reinforce and plug weld corners using heavy extruded aluminum corner keys to ensure maximum strength at these critical stress points.
- .11 Provide glazing stops of interlocking snap-in type for dry glazing.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Set frames plumb, square, level at correct elevation in alignment with adjacent work.
.2 Anchor securely.
.3 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
.4 Adjust operable parts for correct function.
.5 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

3.3 GLAZING

.1 Glaze aluminum doors and frames in accordance with Section 08 80 00 - Glazing.

3.4 CAULKING

.1 Seal joints to provide weather tight seal at outside and air, vapour seal at inside.

.2 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within the aluminum work except where exposed use is permitted by Consultant.

3.5 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 Schedule site visits to review Work at stages listed:

.1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

3.6 CLEANING

.1 Perform cleaning of aluminum components in accordance with AAMA 609.1 - Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum.

.2 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.3 Clean aluminum with damp rag and approved non-abrasive cleaner.

.4 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.

.5 Clean glass and glazing materials with approved non-abrasive cleaner.

.6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 26 00 - Vapour Retarders.
.2 Section 07 92 00 - Joint Sealants.
.3 Section 08 80 00 - Glazing.

1.2 REFERENCES

.1 Aluminum Association (AA), Designation System for Aluminum Finishes (2000)
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-79.1-M91, Insect Screens.
.3 Canadian Standards Association (CSA) International
  .1 CSA-A440.S1, Canadian Supplement.
  .2 AAMA/WDMA/CSA 101/I.S.2/A-440.
  .3 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 DESIGN CRITERIA

.1 CAN3-A440-M90 - Windows.
  .1 Wind load rating - C5.
  .2 Air leakage - A3.
  .3 Water leakage - B7
  .4 Condensation resistance temperature index - I-67.
  .5 Thermal transmittance - 2.1W/m2
  .6 Resistance to Forced Entry - F1
  .7 Insert Screens: S1
  .8 Glazing: G1

1.4 SUBMITTALS

.1 Make submittals in accordance with Division 01 - General Requirements.
.2 Shop Drawings:
  .1 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.
  .2 Each drawing submission shall bear the signature and stamp of a qualified professional engineer registered or licensed to practice in the province of Prince Edward Island.
.3 Maintenance Data:
  .1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into maintenance manual specified in Division 01 - General Requirements.
.4 Closeout Submittals:
  .1 Provide operation and maintenance data for windows for incorporation into manual specified in Division 01 - General Requirements.

1.5 QUALITY ASSURANCE MOCK-UP

.1 Fabricate a mock-up that will demonstrate the various aspects of the air barrier / window connection / cladding (brick, steel, wood, EIFS and/or vinyl) installation and detailing.
.2 The installation is to reflect the intent to have a full tie in of the air barrier to the entire perimeter of all wall openings, including windows, doors and louvers, providing a tight air and water seal and the relationship of the cladding installation to the openings.

.3 The mock-up is to be reviewed by the Contractor, Membrane Installer, Window Installer, Owner and Consultant prior to the Contractor moving forward with the installation of all other windows.
.4 Allow 48 hours to convene the review on site.
.5 Mock-up to be approved prior to fabrication of additional openings.
.6 Openings installed prior to review and approval will be removed at the Contractors expense and rebuilt.
    .1 The approved mock-up may remain on site as part of the work and it will form the standard of acceptance for the remainder of the work.

1.6 PROTECTION

.1 Apply temporary protective coating to finished surfaces. Remove coating after erection and as indicated by Consultant. Do not use coatings that will become hard to remove or leave residue.

1.7 WARRANTY

.1 Contractor hereby warrants aluminum windows against leakage, defects and malfunction under normal usage in accordance with GC12.3, but for 3 years.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MATERIALS

.1 Materials: to CSA-A440/A440.1 supplemented as follows:
    .1 All windows by same manufacturer.
    .2 Exposed nameplates not permitted.
    .3 Aluminum Extrusions: Aluminum Association alloy AA6063-T6 anodizing quality.
    .4 Sheet Aluminum: Aluminum Association alloy AA1100-H14 or AA5005 H32/H34 anodizing quality.
    .5 Thermal Break: Extruded virgin polyvinylchloride.
    .6 Fasteners: Non-magnetic, stain and corrosion resistant stainless steel to ASTM E-149.
    .7 Glass and Glazing materials: In accordance with Section 08 80 00 - Glazing.
    .8 Sealants: In accordance with Section 07 92 00 Joint Sealants.
    .9 Weatherstripping: Extruded flexible EPDM to ASTM D2000.
    .10 Aluminum Sill: Break form sill from 0.87 sheet, Color and finish to match windows.
    .11 Batt Insulation: Fill voids.
    .12 Insect screening plastic coated fiberglas mesh: count 18 x 14.

2.2 WINDOWS

.1 Windows: prefinished aluminum, thermally broken, fixed units with locked-in screwless glass stop to accommodate 45 mm thickness sealed triple glazing, shielded drainage and pressure equalizing vents.
.2 Acceptable Material:
    .1 Kawneer, AA6500 Series Windows, 127mm frame depth
.3 Sealants: in accordance with Section 07 92 00 - Joint Sealants. Color selected by Consultant.
.4 Isolation coating: alkali resistant bituminous paint of epoxy solution.

.5 Colour: Same colour inside and outside. Refer to material / finish schedule for colour. Pre-finished black.

2.3 ACCESSORIES

.1 Exterior sills: Pre-fabricated extruded aluminum sill of type and size to suit configuration shown and job conditions; complete with joint covers, jamb drip deflectors, chairs, anchors and anchoring devices as required for a complete installation.

2.4 HARDWARE

.1 Hardware: Except as noted, comply with the the requirements of BHMA A156.18.
.2 Sash lock: Lever handle with concealed cam lock for multi point locking.
.3 Operator: Geared rotary handle fitted to projecting sash arms with limit stops.
.4 Projecting Sash Arms: stainless steel with 4 bar hinges. Provide limit stop to restrict hinge travel and limit vent opening to 90mm.
.5 Insect screens: plastic coated fiberglass mesh in aluminum frame, as manufactured by the window supplier. Frame finish to be same as windows.

2.5 FABRICATION

.1 Fabricate in accordance with CSA-A440/A440.1 supplemented as follows:
  .1 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
  .2 Face dimensions detailed are maximum permissible sizes.
  .3 Brace frames to maintain squareness and rigidity during shipment and installation.
  .4 Finish steel clips and reinforcement with shop coat primer to CAN/CGSB-1.40 g/m2 zinc coating to CAN/CSA-G164.

2.6 ISOLATION COATING

.1 Isolate aluminum from following components, by means of isolation coating: Dissimilar metals except stainless steel, zinc, or white bronze of small area.
  .1 Concrete, mortar and masonry.

2.7 AIR BARRIER AND VAPOUR RETARDER

.1 Equip window frames with site installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder.
.2 Material identical to, or compatible with building air barrier and vapour retarder materials to provide continuous, uninterrupted air tightness and vapour diffusion control throughout exterior envelope assembly.
.3 Material width adequate to provide required seal to building air barrier and vapour retarder but in no case shall be less than 400mm.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with CSA-A440/A440.1.
.2 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Use one piece mm lengths at each location.
.3 Cut sills to fit 50mm longer than window opening.
.4 Secure sills in place with anchoring devices located at ends joints of continuous sills and evenly spaced 600 mm on center in between.
.5 Fasten expansion joint cover plates with self tapping stainless steel screws.
.6 Maintain 6 to 9 mm space between butt ends of continuous sills. For sills over 1200 mm in length, maintain 3 to 6 mm space at each end.

.7 Set frames plumb, square, level at correct elevation in alignment with adjacent work.
.8 Anchor securely. Do not restrict thermal movement.
.9 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

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 07 92 00 - Joint Sealants. Conceal sealant within window units except where exposed use is permitted by Consultant.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 08 11 13 - Hollow Metal Doors and Frames.
.2 Section 08 14 16 - Flush Wood Doors.
.3 Section 08 41 13 - Aluminum-Framed Entrance and Storefronts.
.4 Electrical wiring.

1.2 REFERENCES

.1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
  .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frames Manufacturer's Association.
.2 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB 69.17 M86(R1993), Bored and reassembled Locks and Latches.
  .2 CAN/CGSB 69.18 M90/ANSI/BHMA A156.1 1981, Butts and Hinges.
  .3 CAN/CGSB 69.19 93/ANSI/BHMA A156.3 1984, Exit Devices.
  .4 CAN/CGSB 69.20 M90/ANSI/BHMA A156.4 1986, Door Controls (Closers).
  .5 CAN/CGSB 69.21 M90/ANSI/BHMA A156.5 1984, Auxiliary Locks and Associated Products.
  .6 CAN/CGSB 69.22 M90/ANSI/BHMA A156.6 1986, Architectural Door Trim.
  .7 CAN/CGSB 69.24 M90/ANSI/BHMA A156.8 1982, Door Controls Overhead Holders.
  .8 CAN/CGSB 69.26 96/ANSI/BHMA A156.10 1991, Power operated Pedestrian Doors.
  .9 CAN/CGSB 69.28 M90/ANSI/BHMA A156.12 1986, Interconnected Locks and Latches.
  .10 CAN/CGSB 69.29 93/ANSI/BHMA A156.13 1987, Mortise Locks and Latches.
  .11 CAN/CGSB 69.30 93/ANSI/BHMA A156.14 1991, Sliding and Folding Door Hardware.
  .12 CAN/CGSB 69.31 M89/ANSI/BHMA A156.15 1981, Closer/Holder Release Device.
  .13 CAN/CGSB 69.32 M90/ANSI/BHMA A156.16 1981, Auxiliary Hardware.
  .14 CAN/CGSB 69.33 M90/ANSI/BHMA A156.17 1987, Self closing Hinges and Pivots.
  .15 CAN/CGSB 69.34 93/ANSI/BHMA A156.18 1987, Materials and Finishes.
  .16 CAN/CGSB 69.35 M89/ANSI/BHMA A156.19 1984, Power Assist and Low Energy Power Operated Doors.
  .17 CAN/CGSB 69.36 M90/ANSI/BHMA A156.20 1984, Strap and Tee Hinges and Hasps.
.3 All hardware shall comply with requirements of the National Building Code (2015).

1.3 REQUIREMENTS OF REGULATORY AGENCIES

.1 Use ULC listed and labeled hardware for doors in fire separations and where noted on Door Schedule (located at the end of this document in the Schedules section).

1.4 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Division 01 - General Requirements.
.2 Hardware List:
  .1 Submit Finish Hardware Schedule electronically for approval.
  .2 Schedule shall be written in accordance with DHI Sequence and Format for vertical hardware schedule publication.
  .3 Schedule shall reference item and door number to hardware set specified.
  .4 Door index to be included referencing the door number to scheduled item number.
  .5 Submit electronic copies of keying schedules for approval.

.6 Schedule shall be written in accordance with DHI Handbook Keying Schedule Systems and Nomenclature. Coordinate all keying in writing.

.3 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.
.2 Provide template drawings as requested.

.4 Closeout Submittals
.1 Provide operation and maintenance data for door closers, lockets, door holders electrified hardware and fire exit hardware for incorporation into manual specified in Division 01 - General Requirements.

1.5 QUALITY ASSURANCE

.1 Hardware supplier must have on staff an Architectural Hardware Consultant or person of equivalent qualification and experience. Hardware supplier must have been in hardware supply for a minimum of two (2) years, have supplied similar type projects, and have adequate facilities to service project.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Trade Contractor to provide clean, dry locked room for storage of hardware on shelving.
.2 Each hardware item shall be delivered to site in manufacturers original packaging. Each item shall be labeled with door and item number to correspond with hardware schedule.
.3 All hardware will be delivered to one receiving are on site.

1.7 WARRANTY

.1 Furnish a one-year written warranty for all products with exceptions of door closers, Mortise locksets and latchsets which shall be warranted for ten (10) years, and exit devices and trim, overhead holders and stops which shall be warranted for five (5) years.

1.8 WASTE DISPOSAL AND MANAGEMENT

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MANUFACTURERS

.1 Acceptable Material: Specified in Hardware Sets.

2.2 FINISH

.1 Finish for this project in general shall be 626 (Satin Chrome). Exceptions are as noted in hardware packages.

2.3 KEYING

.1 All cylinders construction, master keyed.
.2 Provide three (3) master keys for each MK or GMK group.
.3 Stamp keying code numbers on keys and cores.

2.4 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.
.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
.5 Use fasteners compatible with material through which they pass.

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.
.2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
.3 Recommend mounting heights shall be in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturer's Association.
.4 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
.2 Where door stop contacts door pulls, mount stop to strike bottom of pull.
.3 Install key control cabinet.
.4 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
.5 Remove construction cores when directed by Consultant; install permanent cores and check operation of locks.

3.3 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety, weather tight closure and to provide tight fit at contact points with frames.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
.3 Remove protective material from hardware items where present.

3.5 PROTECTION

.1 Provide proper protection of all hardware items until Owner accepts project as complete.

3.6 DOOR HARDWARE SETS

.1 To be issued via addendum.

END OF SECTION

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1 General

1.1 RELATED REQUIREMNETS

.1 Section 08 11 13 - Hollow Metal Doors and Frames
.2 Section 08 14 16 - Flush Wood Doors

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
  .1 ANSI/ASTM E330-02, Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM C542-94(1999), Specification for Lock-Strip Gaskets.
  .2 ASTM D1003-00, Test Method for Haze and Luminous Transmittance of Plastics.
  .3 ASTM D2240-02b, Test Method for Rubber Property - Durometer Hardness.
  .4 ASTM E84-01, Test Method for Surface Burning Characteristics of Building Materials.
  .5 ASTM F1233-98, Test Method for Security Glazing Materials and Systems.
  .6 ASTM C509-06, Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
  .7 ASTM C510-05a, Standard Test Method for Staining and Colour Change of Single or Multicomponents Joint Sealants.
  .8 ASTM C794-06, Standard Test Method for Adhesion in Peel of Elastomeric Joint Sealants.
  .9 ASTM C864-05, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
  .10 ASTM C920-05, Standard Specification for Elastomeric Joint Sealants.
  .11 ASTM C1036-06, Standard Specification for Flat Glass.
  .12 ASTM C1048-04, Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
  .13 ASTM C1115-06, Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
  .14 ASTM C1349-04, Specification for Architectural Float Glass Clad Polycarbonate.
  .15 ASTM C1376-03, Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
  .16 ASTM E1300-07e1, Practice of Determining Load Resistance of Glass in Buildings.
.3 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
  .2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.
  .3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
  .4 CAN/CGSB-12.4-M91, Heat Absorbing Glass.
  .5 CAN/CGSB-12.8-97, Insulating Glass Units.
  .6 CAN/CGSB-12.9-M91, Spandrel Glass.
  .7 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
  .8 CAN/CGSB-12.12-M90, Plastic Safety Glazing.
  .9 CAN/CGSB-12.13-M91, Patterned Glass.
  .10 CAN/CGSB-12.20-M89, Structural Design of Glass for Buildings.
  .11 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.
  .12 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
  .13 CAN4-S104-M80, Fire Test of Door Assemblies.
  .14 CAN4-S106-M80, Fire Test of Windows and Glass Assembles.
.4 Canadian Standards Association (CSA International).
  .1 CSA A440.4, Energy Performance Evaluation of Windows and Sliding Glass Doors.
  .2 CSA Certification Program for Windows and Doors 2000.

.5 Flat Glass Manufacturers Association (FGMA).
.1 FGMA Glazing Manual - 1997.
.6 Laminators Safety Glass Association (LSGA).
.1 LSGA Laminated Glass Design Guide 2000.
.7 NFPA
.1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
.2 ULC, Underwriters Laboratories of Canada Building Materials and Systems Directory, Fire Resistance Directory, Current Edition including Supplements to date.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:
.1 Design glass and glazing to CAN/CGSB-12.20-M.
.2 Provide accessories, closures and trims required and necessary to complete work.
.2 Performance Requirements:
.1 Ensure solvents and/or other volatile elements in glazing system do not affect properties and performance of materials used for edge seal and sealant glass bond.
.2 Ensure materials used for edge seals are compatible with other materials they come in contact within glazing system. If required, perform compatibility tests to ASTM C510, ASTM C794 and ASTM C1087, or others as applicable.
.3 Use sealants and other materials in glazing system which are unaffected by long term UV light exposure.

1.4 SUBMITTALS

.1 Submit Product Data, Samples, Manufacturer's printed product literature, specifications and data sheet in accordance with Division 01 - General Requirements.
.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheets.
.3 Samples:
.1 Submit duplicate 300 mm size samples of each sealed glazing unit.
.2 Submit duplicate 100 x 100 mm size samples of colored glass unit specified.
.4 Material Safety Data Sheets:
.1 Submit MSDS for inclusion in Operation and Maintenance Manual.
.5 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.
.6 Closeout Submittals:
.1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Division 01 - General Requirements.

1.5 QUALITY ASSURANCE

.1 Test Reports: provide certified test reports showing compliance with specified performance characteristics and physical properties.
.2 Certificates: provide product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
.3 Pre-installation Meetings: attend pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.
.4 Provide maintenance data including cleaning instructions for incorporation into manual specified in Division 01 - General Requirements.
.5 Perform work in accordance with FGMA Glazing Manual, IGMAC and Laminators Safety Glass Association - Standards Manual for glazing installation methods.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver glass and associated materials to site in original crates and containers with manufacturer's name and brand distinctly marked thereon and with glass labelled as to types. Do not remove labels on glass until after work is accepted by Consultant.

.2 Store materials within the building, in a clean, dry location, acceptable or as designated by Consultant. Fully protect materials from damage of any kind until ready for use.

1.7 PROJECT CONDITIONS

.1 Environmental Requirements: No glazing done when temperature is less than 7 deg C or sash or frames are wet, damp or frosted.
.2 Protect work of other trades from damage resulting from work of this Section.
.3 Identify glazed openings immediately following glass installation. Use coloured tapes or flags suspended near, but not in contact with glass. Attach to frames or surround with suitable non-staining strippable adhesives or tapes.

1.8 WARRANTY

.1 Warrant factory sealed insulating units for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract.
.2 Warrant that factory sealed insulating units be free from material obstruction of vision as result of dust or film formation on internal glass surfaces by any cause, under normal conditions anticipated under this Project, other extrinsic glass breakage, but including breakage due to thermal shock and temperature differential due to inherent glass or glazing fault.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 ACCEPTABLE MATERIALS

.1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
  .1 AGC Flat Glass North America, Ltd.; www.na.agc-flatglass.com.
  .2 Ace Security Laminates; www.acesecuritylaminates.com.
  .3 Barber Glass Industries; www.barberglass.com.
  .4 GE Silicones; www.gesilicones.com.
  .5 Guardian Industries Corp.; www.guardian.com.
  .6 PPG Canada Inc.; www.ppgglass.com.
  .7 Pilkington Special Glass Limited; www.pilkington.com.
  .8 Prelco Inc.; www.prelco.com.
  .9 Schott North America Inc.; www.us.schott.com.
  .10 Viracon Inc.; www.viracon.com.
  .11 Tremco Canada; www.tremcosealants.com.
  .12 Trulite Industries Limited; www.trulite.com.

2.2 MATERIALS: FLAT GLASS

.1 Glass: Free from bubbles, waves, discolouration and other defects and of following types for locations indicated on Drawings or noted on Door Schedule. Ensure glass bears manufacturer's label indicating quality. Leave labels in place until final cleaning.
.2 Single Glazed Glass Types:
  .1 Float Glass: Conforming to CAN/CGSB-12.3-M, clear transparent float glass, minimum 6 mm.
  .2 Tempered Glass:

.1 Minimum 6 mm.
.2 Conforming to ASTM C1048, CAN/CGSB-12.1-M, Type 2 tempered, Class B float glass, Category II.
.3 Perform heat strengthening using horizontal tong free method; surface compression not less than 7500 psi.

.3 Tempered Laminated Glass:
.1 Minimum 6 mm.
.2 Two layers of fully tempered safety glass conforming to ANSI Z97.1, ASTM C1048 and CAN/CGSB-12.1-M, Type 2, Class B, Category II laminated together under heat and pressure with clear PVB interlayer of 0.8 mm thick between them to create single unit.
.3 Perform heat strengthening using horizontal tong free method; surface compression less than (7500 psi).

.4 Clear, ceramic, wireless safety glass: to CAN4-S104, CAN4-S-106, ASTM-E-152, ASTM-E-163, of 5 mm thickness, with polished surfaces.
.1 Acceptable Material:
.2 Premium Firelite.

.3 Structural Glazing Sealant:
.1 One component silicone base sealant, chemical curing conforming to CAN/CGSB-19.13-M, Classification MCG-2-25-A-N and ASTM C1184 unless otherwise approved and/or directed.
.2 Suitable for metal, concrete and glass, non- sagging for vertical joints, capable to resist 25% movement with total loss of bond as specified in Standard, suitable for glazing, resists UV through glass, normal temperature, minimum application temperature 5 deg C.
.3 Sealant shall be UV resistant, ozone resistant, non-bleeding, non-staining and capable of supporting their own weight, structural glass units and all specified or referenced loads to meet design criteria and in conformance of OBC requirements.
.4 Acceptable Material for shop glazing:
.1 "Proglaze II Multi Component" by Tremco Canada;
.2 "Ultraglaze 4400" (where recommended by manufacturer) by GE Silicones;
.3 "DC-983" by Dow Corning Canada.
.5 Acceptable Material for field glazing:
.1 "Spectrum® 2 or Proglaze SG" by Tremco Canada;
.2 "Ultraglaze 4400" or "Ultraglaze 4000" by GE Silicones;
.3 "DC-795" by Dow Corning Canada.
.6 Sealant for Heel Bead Airseal at Windows:
.1 Acceptable Material:
.1 One component, medium modulus silicone sealant.
.2 "SilGlaze II SCS2800" by GE Silicones.
.3 "Tremsil 600" by Tremco Canada.

.4 Window Film:
.1 Translucent opacity, transparent synthetic liner, clear pressure sensitive adhesive.
.2 Film shall have cutouts to suit design and be located as indicated on Drawings.
.3 Provide "3M Scotchcal ElectroCut Special Effects Film" by 3M; www.3m.com in colour "7725-314 Dusted Crystal".

.5 Glazing, Sealing Compounds and Accessories:
.1 Ensure glazing, sealing compounds and accessories are compatible with all contact surfaces of frames, other accessories used in glazing system and contact surfaces of compounds used on insulated glass units.
.2 Wood or other organic materials are not acceptable for use in glazing systems including spacer blocks.
.3 Glazing Compound:
.1 Non-hardening modified oil type.
.2 Colour to match adjacent surfaces unless indicated otherwise.

.4 Sealant Compound: One component type, elastomeric chemical curing, CAN/CGSB-19.13-M, Class G-2-25-A-N. Colour to match adjacent surfaces unless indicated otherwise.

.5 Sealant Compound:
- .1 CAN/CGSB-19.24-M, multi-component chemical curing, Type 2, Class A.
- .2 Colour to match adjacent surfaces.

.6 Sealant Compound:
- .1 One component, silicone base solvent curing.
- .2 Colour to match adjacent surfaces.

.7 Elastomeric Joint Sealants: ASTM C920.

.8 Sealant for Interior Glass-to-Glass Butt Glazing Installation:
- .1 Translucent 1 part silicone sealant conforming to U.S. Federal Specification TT-S-001543 (Silicone Building Sealant) and TT-S-0230, CAN/CGSB-19.13-M and ASTM C920, (One Component Building Sealant).
- .2 "Tremsil 200" by Tremco Canada;
- .3 "DC 999" by Dow Corning Canada.

.6 Sealant for Use With Plastic Polymer Glazing:
- .1 One component silicone base sealant, chemical curing conforming to CAN/CGSB-19.13- M, Classification MGC-2-25-A-N or BN unless otherwise directed.
- .2 Acceptable Material;
  - .1 "LexSil SPS 2900 Primerless Silicone.
  - .2 Plastic Sealant" by GE Silicones
  - .3 "Spectrum I" by Tremco Canada.

.7 Cellular Gaskets for Compression Glazing:
- .1 ASTM C509 cellular, elastomeric, preformed, black.
- .2 Closed cell neoprene or EPDM extrusions including molded corners where applicable by Cellular Rubber Extrusions Tremco Canada.

.8 Dense Gaskets for Compression Glazing:
- .1 ASTM C864, Option II or ASTM C1115, Type C, dense neoprene or EPDM extrusions, 60 and 70 Durometer density including molded corners where applicable.
- .2 Poly-Wej Gaskets Tremco Canada.

.9 Glazing Splines:
- .1 Neoprene or EPDM manufacturer's standard dry glazing splines to suit aluminum extrusions.
- .2 Colour to match adjacent surfaces unless indicated otherwise

.10 Glazing Points and Wire Spring Clips:
- .1 Corrosion resistant, manufacturer's standards.

.11 Edge Blocking, Setting Blocks, Later Shims, Gaskets and Tapes:
- .1 Edge Blocking for Glass:
  - .1 60 - 70 Durometer neoprene, silicone or EPDM, channel shaped, 100 mm - 150 mm long.
- .2 Setting Blocks:
  - .1 7 mm x 100 mm EPDM or extruded 80-90 Durometer neoprene; at insulating glass, use EPDM only. At fire-rated glazed doors and partitions, use similar sized fire-rated silicone GE "Gel 516" or asbestos cement blocks.
  - .2 Width; 1.6 mm to 3 mm less than design glazing pocket width.
  - .3 For 4 sided structural glazing, use silicone compatible rubber or silicone.
- .3 Lateral Shims:
  - .1 Neoprene, silicone or EPDM, 40 - 60 Durometer, 100 mm long or as required.
- .4 Non-Compression Glazing Tape for Interior Aluminum Screen Glazing:
  - .1 Preformed, 100% solids, cross linked butyl rubber, polyisobutylene, hardness 65 Durometer, unaffected by UV through glass.
  - .2 Tape shall be sufficiently wide and thick as to completely cover bite area of glazing unit when the unit is pushed into place.

.3 Acceptable Material shall be "Tremco 440 Tape" by Tremco Canada.

.5 Compression Glazing Gaskets for Interior Aluminum Screen Glazing:

.1 EPDM, neoprene, thermoplastic or other acceptable material with Shore A Durometer of 35, ± 5.

.2 Dual Durometer gaskets of a specific acceptable type are also acceptable.

.3 Ensure material has sufficient thickness or be of a configuration to allow 25% compression when installed, have a minimum 2000 psi (1500 psi for silicone) tensile strength, resistance to permanent set of 30% maximum, minimum elongation at break of 300% (700% for silicone) and resistance to ozone showing no cracks. "VISIONstrip®" by Tremco Canada.

.4 Acceptable material: Armet, Dow Corning and PTI.

.6 Compression Glazing Tape:

.1 Preformed, ribbon-shaped, non-skinning, 100% solids, non-oxidizing polyisobutylene: butyl, paper release, EPDM shim with continuous synthetic rubber spacer rod of 60 Durometer hardness.

.2 Ensure tape is sufficiently wide and thick to completely cover bite area of glazing unit when unit is pushed into place.

.3 Acceptable material: Polyshim II Tape" by Tremco Canada.

.12 Primer Sealers and Cleaners: To glass and plastic glazing manufacturer's standards.

2.3 MATERIALS: SEALED INSULATING GLASS

.1 Insulating glass units: At all exterior doors, exterior sidelights and exterior windows.

.2 Triple glazed units: to CAN2-12.8M76(R1979) with all 3 panes of 6mm thick high performance glass, two 12mm air spaces, glass with 0.10 low emissivity coating on surface 5, argon gas filled interspaces and insulating silicone-foam edge spacer. Metal edge spacers not acceptable.

.3 Tempered glass to be provided at all interior and exterior aluminum doors and side lights. Tempered glass at both inner and outer pane.

.4 Tempered glass to be provided at all interior and exterior glazed units where the glass is within 1500mm of floor level.

.5 Acceptable Material:

.1 PPG, Solarban 60 Solar Control Low-E glass, VLT 70, SHGC 0.39.

2.4 ACCESSORIES

.1 Qualified products: only compounds listed on the CGSB Qualified Products list are acceptable for use on this project.

.2 Glazing compound: oil base, to CAN/CGSB-19.6, Type 1, color to match adjacent metal.

.3 Sealant compound: one component acrylic base, to CGSB 19-GP-5M, gun grade, color to match adjacent material.

.4 Sealant compound: two-component polysulphide base, to CAN2-19.24, gun grade, color to match adjacent metal.

.5 Glazing splines: E.P.D.M. or neoprene. Manufacturer's standard dry glazing splines to suit aluminum extrusions, black color.

.6 Glazing points and wire spring clips: corrosion resistant, manufacturer's standard.

.7 Cap bead: one component silicone, neutral cure, CGSB 19-GP-23, gun grade, color white.

.1 Acceptable material:

.1 Tremco "Spectrum 2".

.2 Sonneborn "Omniseal".

.8 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, length of 25 mm for each square meter of glazing.

.9 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.

.10 Glazing tape:

.1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; size as required; black/ bronze color.

.11 Glazing clips: manufacturer's standard type.

.12 Glazing points and wire spring clips: corrosion resistant, manufacturer's standard.

.13 Lock-strip gaskets: to ASTM C542.

.14 Cap bead: one component silicone, neutral cure, to CGSB 19-GP-23, gun grade, color white. Acceptable material:

.1 Trecmo "Spectrum 2"

.2 Sonneborn "Omniseal"

.15 Primer-sealers and cleaners: to glass manufacturer's standard.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 FABRICATION

.1 Label each light of glass and/or plastic glazing with registered name of Product and weight and quality of glass and/or plastic glazing.

.2 Check dimensions on job site before cutting materials.

.3 Ensure minimum bite or lap of glass and/or plastic glazing on stops and rabbets as recommended by glass and/or plastic glazing manufacturer.

3.3 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.4 PREPARATION

.1 Thoroughly clean glass rebates and glass of dust, dirt, mortar and other foreign materials prior to glazing. Remove oils and grease with non-staining solvents such as Xycol or Methyl Ethyl Ketone solutions.

3.5 WORKMANSHIP

.1 Remove protective coatings and clean contact surfaces with solvent and wipe dry.

.2 Apply primer-sealer to contact surfaces.

.3 Place setting blocks as per manufacturer's instructions

.4 Install glass, rest on setting blocks, ensure full contact and adhesion at perimeter.

.5 Install removable stops, without displacing tape or sealant.

.6 Provide edge clearance of 3 mm minimum.

.7 Insert spacer shims to center glass in space. Place shims at 600 mm oc and keep 6 mm below sight line.

.8 Apply cap bead of sealant at full perimeter of exterior, at all aluminum window glazing.

.9 Apply sealant to uniform and level line, flush with sight line and tooled or wiped with, solvent to smooth appearance.

.10 Do not cut or abrade tempered, heat treated, or coated glass.

3.6 INSTALLATION: INTERIOR GLAZING

.1 If required, thoroughly mix glazing compound as recommended by manufacturer. Thinning of glazing compound will not be permitted.

.2 Carefully remove glazing stops and replace after glazing. Take care to prevent damage to stops.

.3 Doors, Screens, Sidelites and Interior Windows:

.1 Place setting blocks on sill at 1/4 points from each corner unless otherwise directed by glazing manufacturer.

.2 Place continuous glazing gaskets on edges of glass.

.3 Centre and space each piece of glass with spacers located and installed according to manufacturer's directions.

.4 Place glass so no voids occur between glass and glazing material, and glazing stops.

.5 Secure glass in place with stops, secured in place with screws.

.4 Glazing Sealant:

.1 Apply glazing sealant to clean, dry, grease and oil free surfaces. Provide exposed glazing sealant smooth, free from ridges, wrinkles, air pockets and embedded foreign materials.

.2 Prime surfaces if required by glazing sealant manufacturer.

.3 Trim glazing sealant flush with tops of stops and glazing channels.

.4 Remove excess glazing sealant or droppings which would set up or become difficult to remove from finished surfaces. Remove excessive sealant immediately. Do not use chemicals, scrapers, or other tools which would affect finished surfaces.

.5 Interior Glazing:

.1 Fire Rated Hollow Metal Doors and Screens:

.1 Set glass in fire rated metals doors and screens on continuous setting block with 3 mm gap between glazing stop glass and embed in glazing compound in accordance with NFPA 80 and OBC requirements. Strike and point exposed joints between metal and glass or Install glass in accordance to ULC tested proprietary methods of installation.

.2 Combination Method-Tape/Sealant:

.1 Cut glazing tape to proper length and Install against permanent stop projecting 1.5 mm above sightline.

.2 Fill gap between glass and applied stop with sealant to depth equal to bite of frame on glass to uniform and level line.

.3 Trim off excess tape to sightline.

.3 Two Sided Butt - Joint Glazing:

.1 2 side glazing at head and sill use wet, dry, or wet/dry glazing systems.

.2 Position glazing so that vertical edges are spaced slightly apart and seal with silicone sealant.

.3 Grind vertical joint with slight kerf and polish for aesthetics.

.6 Window Film:

.1 Install window film in accordance with manufacturer's printed instructions by experienced film applicators as recommended by glass film manufacturer.

.2 Ensure glass surfaces are clean and ambient temperature is between 16 deg C and 38 deg C.

.3 Whenever 2 or more pieces of same colour translucent film are seamed together as a continuous band of colour, they shall be matched to assure uniform reflected daytime colour and transmitted night appearance.

3.7 ALUMINUM DOORS, TRANSOMS LIGHTS AND SIDELIGHTS

.1 All doors and transoms lights to be glazed with 25mm insulating units, in accordance with the requirements of this Section, to door manufacturer's standard glazing installation practice unless noted otherwise on drawings.

3.8 ALUMINUM WINDOWS

.1 All windows to be glazed with 25mm thickness insulating units in accordance with the requirements in this Section, to window manufacturer's standard glazing installation practice.

.1 Provide cap bead of sealant at all four (4) sides, at exterior of each unit.

.2 All doors transoms and side lights to be glazed with 25 mm insulating units, in accordance with the requirements of this Section, to door manufacturer's standard glazing installation practice unless noted otherwise on drawings.

.3 All partitions and borrowed lights, to be glazed with 6 mm thickness clear, laminated safety glass, in accordance with the requirements of this Section.

.4 Where indicated on drawings, frames to be glazed with wired safety glass in accordance with the requirements of this Section.

.5 All fire-rated hollow metal doors to be glazed with 6 mm thickness clear, ceramic safety glass, in accordance with the requirements of this Section.

.6 Use insulated glass units for all exterior doors in heated spaces.

.7 All non-fire rated hollow metal doors to be glazed with 6 mm thickness clear laminated or tempered safety glass in accordance with the requirements of this Section.

.8 Use tempered insulated glass doors for all exterior doors.

3.9 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking.

.3 Remove glazing materials from finish surfaces.

.4 Remove labels after work is complete.

.5 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.

.6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.10 PROTECTION OF FINISHED WORK

.1 Provide and maintain necessary protection of completed work against damage.

.2 Do not mark or attach anything directly to exposed glass and framing surfaces.

.3 If welding is to take place above or near completed glazing work, protect glass with plywood or other suitable means to reduce likelihood of weld spatter damaging glass surfaces.

.4 Protect glass from other trades, workers, tools and other similar materials.

.5 Replace cracked, broken, or defective glass at no additional cost to the Owner and to Consultant's satisfaction.

.6 Identification of Glazing: Mark glass lites with temporary, easily removable, large safety markings, immediately after glass installation. Maintain safety markings until final clean-up.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 - Metal Fabrications.
.2 Section 07 21 16 - Blanket Insulation.
.3 Section 07 26 00 - Vapour Retarders.
.4 Section 08 11 13 - Steel Doors and Frames.
.5 Section 09 22 16 - Non-Structural Metal Framing.
.6 Section 09 91 00 - Painting.
.7 Division 23 - Mechanical - Supply of access doors.
.8 Division 26 - Electrical - Supply of access doors.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
  .1 ASTM C36/C36M-01, Specification for Gypsum Wallboard.
  .2 ASTM C79/C79M-01, Standard Specification for Treated Core and Non-treated Core Gypsum Sheathing Board.
  .3 ASTM C442/C442M-01, Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
  .4 ASTM C475-01, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
  .5 ASTM C514-01, Specification for Nails for the Application of Gypsum Board.
  .6 ASTM C557-99, Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
  .7 ASTM 1396, Specification for Water-Resistant Gypsum Backing Board.
  .8 ASTM C840-01, Specification for Application and Finishing of Gypsum Board.
  .9 ASTM C931/C931M-01, Specification for Exterior Gypsum Soffit Board.
  .10 ASTM C954-00, Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
  .11 ASTM C1002-01, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  .12 ASTM C1047-99, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
  .13 ASTM C1280-99, Specification for Application of Gypsum Sheathing Board.
  .14 ASTM C1177-01, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  .15 ASTM C1178/C1178M-01, Specification for Glass Mat Water-Resistant Gypsum Backing Board.
.2 Association of the Wall and Ceilings Industries International (AWEI)
.3 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  .2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.
.4 Underwriters' Laboratories of Canada (ULC)
  .1 CAN/ULC-S102-1988(R2000), Surface Burning Characteristics of Building Materials and Assemblies.

1.3 DEFINITIONS

.1 Drywall = Gypsum Board = Gypsum Wall Board = GB = GWB

1.4 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Obtain services of professional engineer with experience in type of work of comparable complexity and scope, licensed to practice in Province of Prince Edward Island to design, review and Provide professional services for work of this Section.

.2 Design ceiling suspension system in accordance with manufacturer's printed directions and conforming to ASTM C754 requirements. Do not suspend any items from structural steel deck. Do not support work of this Section from, nor make attachments to, ducts, pipes, conduits or support framing of other trades.

.3 Design exposed to view ceiling suspension system for 'floating ceiling' and take extra care to ensure that hanger rods are vertically plumb, evenly and neatly spaced and neatly tied with tie wire free of any kinks complete with fascia trim. Install fascia trim in accordance with manufacturer's recommendations.

.4 Design suspended ceiling system for adequate support of electrical fixtures as required by current bulletin of Electrical Inspection Authority.

.5 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

.6 Design suspension system to support weight of mechanical and electrical items such as air grilles, lighting fixtures, drapery track, drapes and with adequate support to allow rotation / relocation of light fixtures.

.7 Design exterior soffit and ceiling system where applicable to withstand positive and negative wind loads effect to suit Project design requirements.

.8 Design sub-framing as necessary to accommodate, and to circumvent, conflicts and interferences where ducts or other equipment prevent regular spacing of hangers.

.9 Design metal stud reinforcements from hollow structural steel, stud, angle and steel plate sections, galvanized sheet steel minimum 1.214 mm (designation thickness 43 mils/minimum base steel thickness 1.087 mm (colour yellow / 18 ga) where required to support of manufactured components without limitations items such as washroom accessories, expansion control covers and similar items. Design weld connections ensuring rigid and secure installation capable of offering resistance to minimum 227 kg pull force. Consider galvanized items in moist areas. Do not design using wood blocking for this purpose.

.10 Design fire rated construction including ceiling, partition or fire protective membranes and furring to approved ULC design or other design acceptable to authorities having jurisdiction, to provide design fire rating indicated and/or required. Submit written evidence of acceptable test design.

.11 Provide sound rated construction having STC rating indicated and tested in accordance with ASTM E90.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature minimum 10°C, maximum 21°C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.

.2 Ensure relative humidity in building is acceptable to material suppliers prior to commencement of installation.

.3 Apply board and joint treatment to dry, frost free surfaces.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site with manufacturer’s original labels intact. Do not remove wrappings until ready for use.

.2 No outside storage permitted. Store in clean, dry area, off ground. Provide adequate ventilation to avoid excess moisture, surface relative humidity and mould or fungal growth. Remove immediately any board showing signs of mould, mildew or fungal growth.

.3 Stack gypsum board flat on level and dry surface without overhanging boards. Prevent sagging and damage to edges, ends and surfaces. Protect bagged products from moisture or wetting.

1.7 SUBMITTALS

.1 Make submittal in accordance with Division 01 - General Requirements.
.2 Product Data:
  .1 Submit manufacturer's literature, data sheets for each type of material provided under this Section for Project. Data sheets shall provide all required information. Submit manufacturer's installation instructions.
.3 Material Safety Data Sheets:
  .1 Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants, patching and leveling compound, solid polymer and as designated later by Consultant.
.4 Shop Drawings:
  .1 Submit Shop Drawings showing design, construction, sound attenuating construction, adjacent construction, locations of access panels, elevations, finishes and relevant details of furring, enclosures and partitions which require fire rating.
.5 Certificates:
  .1 Submit certification from structural engineer registered in Province of Prince Edward Island, who shall affix his/her seal and signature to certificate, stating that installed suspended ceiling system is capable of supporting its own weight and weight of lighting, grilles and other mechanical and electrical fixtures required by Mechanical and Electrical Divisions.
  .2 Obtain approval of electrical utility authorities having jurisdiction for support of light fixtures, by ceiling grid and supports, to satisfy requirements of electrical inspection authority having jurisdiction. Adjust grid, fixing devices and support hangers as required to obtain approval.
  .3 Samples:
    .1 When requested, submit samples in accordance with Division 01 - General Requirements.
    .2 Each trim accessory minimum 300 mm long.
.6 Quality Assurance:
  .1 Applicator Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years experience in application of Products, systems and assemblies specified.
  .2 Comply with ASTM C840 for application and finishing gypsum board and manufacturer's written information.
  .3 Comply with following guide recommendations unless specified otherwise:
    .1 Applications Guide CGC folder SA-130;
    .2 Fire Resistant Assemblies CGC folder SA-100;
    .3 Acoustical Assemblies CGC folder SA-200;
    .4 Abuse-Resistant Assemblies CGC folder SA-929;
    .5 Moisture Resistant Assemblies CGC folder SA-934;
    .6 Shaft Wall Systems CGC folder SA-926;
    .7 Gypsum Fire Wall Systems CGC folder SA-925.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MANUFACTURERS

.1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
- .1 Bailey Metal Products Ltd.; www.bmp-group.com.
- .2 CertainTeed Gypsum Canada Inc.; www.certainteed.com
- .3 CGC Inc.; www.cgcinc.com
- .4 Georgia-Pacific Canada, Inc.; www.gpgypsum.com
- .5 Acadia Drywall Supplies Ltd; www.acadiadrywall.com
- .6 Gordon Incorporated; www.gordongrid.com
- .7 Roll Formed Specialty; www.rollformed.com
- .8 Cabot Gypsum.

2.2 ACCEPTABLE MATERIALS

.1 Fire Rated Gypsum Board (where identified):
- .1 Fire Rated Gypsum Board having Testing Agency Fire Rating Identification Stamp on Each Sheet
- .2 ASTM C1396M, Type X, 15.9 mm thick gypsum board 1200 mm wide, maximum practical length and tapered edge as required by each fire resistance assembly.
- .3 Acceptable Material:
  - .1 CGC Gyproc Firecode C.
  - .2 Georgia Pacific Gyproc Fireguard Type X.
  - .3 CertainTeed Fi-Rock Type X.
  - .4 Temple-Inland Gypsum Board Fire-Resistant Type X.

.2 Standard Gypsum Board:
- .1 To ASTM C 3696. 15.9 mm thick, 1219 mm wide x maximum practical length, Ends square cut, edges tapered.
- .2 Acceptable Materials:
  - .1 CGC Inc.
  - .2 CertainTeed Gypsum Canada.
  - .3 G-P Gypsum.
  - .4 Temple Island.
  - .5 Cabot Gypsum.

.3 Moisture Resistant Gypsum Board:
- .1 Use Type X where rating requires ASTM C 1658 regular, 15.9 mm thick, 1219 mm wide x maximum practical length. Use in rooms containing a shower (except where shown to receive cementitious backer board), all washrooms, shower rooms, tubroom, soiled utility and behind sinks (450 mm from center line of fixture, both directions to above ceiling.
- .2 Sink area at janitor closets (1219 mm both directions from center line of sink to above ceiling).
- .3 Acceptable Materials:
  - .1 Georgia Pacific DensArmor Plus.
  - .2 Georgia Pacific DenShield Tile Backer.
  - .3 CertainTeed ProRoc Moisture and Mold Resistant Board.
  - .4 CertainTeed M2 Tech.
  - .5 GreenGlass Interior Gypsum Board by Temple-Inland.
  - .6 Fiberock Aqua Tough by CGC.
  - .7 Sheetrock Mold Tough, by CGC.

.4 Tile and Seamless Wall Coating Backer:
- .1 Use behind all ceramic tile wall finishes.
- .2 Conform to ASTM C1178M and ASTM C1396M, paperless, glass mat reinforced, water resistant treated core gypsum board.

.3 Rating of 10,' no mold growth' as tested for 4 weeks according to ASTM D3273.
.4 Permeance of
.5 Acceptable Materials:
.1 DensShield Tile BackerTM by Georgia-Pacific Canada, Inc.
.2 Green Glass Tile Backer by Temple-Inland.
.3 Sheetrock Mold Tough, by CGC.

.5 Cementitious Backer Board:
.1 Use at locations noted.
.2 Glass mesh mortar unit to ANSI A11/.9, 12.7 mm thick, 914 mm width, round tapered edges.
.3 Acceptable Materials:
.1 Canadian Gypsum Durock Tile Backer Board;
.2 Domtar DonCrete Cementitious Tile Backer Board;
.3 Laticrete International Inc. Wonderboard;
.4 Louisiana-Pacific Canada Ltd. Gypsheathing.
.5 National Gypsum Perma Base Cement Board.

.6 Impact Resistant Gypsum Board:
.1 Multipurpose board, core of fibre-reinforced gypsum and perlite between layers of fibre- reinforced gypsum with fibreglass mesh reinforcement embedded; 12.7 mm or 15.9 mm thickness equivalent to Type X gypsum board when tested in accordance with ASTM E119 and CAN/ULCS101-M.
.2 To CAN/CAS-A82.27, 16 mm thick, 1219 mm wide x maximum practical lengths to be used where indicated on finish schedule and:
.1 All corridors to 1219mm Above Finished Floor.
.2 All janitor closets to 1219mm Above Finished Floor (except sink area) to be moisture resistant.
.3 All soiled utility rooms to 1219mm Above Finished Floor (except sink areas) to be moisture resistant.
.3 Acceptable Materials:
.1 Sheetrock Mold Tough VHI Firecode X manufactured by CGC.
.2 Air Renew Extreme Impact Gypsum Board as manufactured by CertainTeed,
.3 ToughRock Fireguard Type X Abuse Guard Gypsum Board as manufactured by Dens Armour Plus,
.4 ComfortGuard IR by Temple-Inland

.7 Gypsum Exterior Soffit Board:
.1 Glass mat reinforced, treated core gypsum board conforming to ASTM C1177M and ASTM D3273 with a rating of 10, no mould growth after 4 weeks exposure, Type X 15.9 mm thick exterior ceiling panel, weather and sag resistant.
.2 Acceptable Materials:
.1 DensGuard Dens Glass Gold by Georgia-Pacific Canada, Inc.
.2 GreenGlass Exterior Sheathing by Temple-Inland.

.8 Exterior Gypsum Sheathing Board:
.1 Glass mat reinforced, treated core gypsum board conforming to ASTM C1177M, non combustible according to ASTM E136/CAN4-S114-M, flame spread 0, smoke developed 0 to ASTM E84/CAN/ULC-S102-M and ASTM D3273 with a rating of 10, no mould growth after 4 weeks exposure, 16 mm thick Type X gypsum board 1200 mm wide by maximum practical length, tapered edge as required.
.2 Acceptable Materials:
.1 DensGuard DensGlass Gold Exterior Guard by Georgia-Pacific Canada, Inc.
.2 GlasRoc Sheathing by CertainTeed Gypsum, Canada Inc.
.3 Securock Glass Mat Sheathing by CGC Inc.
.4 GreenGlass Exterior Sheathing by Temple-Inland.

.9 Drywall Furring Channels:
.1 0.5 mm (25 gauge) core thickness galvanized steel channels for screw attachment of gypsum board.

.10 Resilient Drywall Furring Channels:
- .1 0.5 mm (25 gauge) base steel thickness galvanized steel for resilient attachment of gypsum board.

.11 Nails:
- .1 To ASTM C 514.

.12 Steel drill screws:
- .1 To ASTM C 1002.

.13 Polyethylene:
- .1 To CAN/CGSB-51.34, 10 mil.

.14 Insulating Strip:
- .1 Rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 13 mm wide, with self sticking permanent adhesive on one face, lengths as required.

.15 Plywood:
- .1 19 mm Douglas Fir Shop Grade.

.16 Laminating compound:
- .1 To CSA A82-31 asbestos free.

.17 Joint Compound:
- .1 Special setting type compound: chemically setting, sandable, to ASTM C475.
- .2 Acceptable Material:
  - .1 Canadian Gypsum Company Sheetrock 90.
  - .2 CertainTeed ProRoc Moisture and Mould resistant 90 Setting Compound with M2Tech.
  - .3 Acadia Drywall Sandable 90.

.18 Taping compound:
- .1 Pre-mixed, to ASTM C475.
- .2 Acceptable Materials:
  - .1 Canadian Gypsum Company All Purpose Ready-to-Use Joint Compound.
  - .2 CertainTeed ProRoc Moisture and Mould resistant 90 Setting Compound with M2Tech.
  - .3 Acadia Drywall Platinum Lite.

.19 Tape:
- .1 50mm wide x 0.25mm thick, perforated paper, with chamfered edges.

.20 Bonding Adhesive:
- .1 Type for purpose intended and as recommended and approved by manufacturer (Lepage PL 200 or PL 400).

.21 Metal Accessories:
- .1 Corner Beads Minimum 0.40mm, Z180 zinc coated sheet steel to ASTM A525; beaded angle; flanges 32mm for 16mm board.
- .2 Casing Beads: Minimum 0.40mm, Z180 zinc coated sheet steel to ASTM A525; "L" type; beaded angle or casing with one (1) side knurled for joint filling; suitable for 15.9mm wallboard, as specified.
- .3 Casing Beads, corner beads, control joints and edge trim: to ASTMC 1047, Zinc metal, zinc-coated by hot-dip process zinc-coated by electrolytic process aluminum coated phosphatized, 0.5mm base thickness, perforated flanges, one piece length per location.
- .4 Flexible Casing Beads:
  - .1 0.531 mm (designation thickness 18mils/minimum base steel thickness 0.455 mm /25 ga) steel, wipe coated, angle shaped in size to fit over edge of gypsum board, to suit curved applications.
- .5 Control joint strip: Roll formed from galvanized steel sheet, with a tape-protected recess, 6mm wide x 41mm deep.

.22 Access Doors and Panels:
- .1 Supplied as part of Division 21, 22 23 and 26 for installation as part of this Section.
- .2 Sized to suit requirements of other Sections, but minimum size 406 mm x 406 mm with drywall bead frame and key operated cylinder lock.

.3 Provide closed cell neoprene gaskets to provide air tight fit.
.4 Fire rated access panels shall conform to requirements of authorities having jurisdiction under law and shall be labeled.

.23 Water:
.1 Fresh clean potable water, free from deleterious matter, acids or alkalies.

.24 Fire Wall Identification:
.1 Paint to be ICI Dulux 14030 Interior Acrylic Low sheen eggshell.

.25 Acoustical/Fire Insulation:
.1 Refer to Section 07 21 16 - Blanket Insulation.

.26 Sound Control Materials:
.1 Sound Attenuation Batts: Refer to and conform to requirements of Section 07 21 16 - Blanket Insulation to meet design requirements.
.2 Strip Impalement Clips:
.1 25 mm wide strip of Insul-Hold by Insul-Hold Canada Ltd., fabricated from 0.531 mm (designation thickness 18mils / minimum base steel thickness 0.455 mm (25 ga) galvanized sheet metal in 30 m rolls with punch-out insulation securement arrows. Alternatively, use special studs with punch-out impalement strips.
.3 Elastomeric Sealant:
.1 As recommended by manufacturer of fibre-reinforced gypsum sheathing board.
.4 Gaskets:
.1 Closed cell neoprene, 3 mm thick x 64 mm wide.
.5 Asphalt Felt:
.1 CSA A123.3; No. 15 Type.

.27 Sealants:
.1 In accordance with Section 07 92 00 - Joint Sealants.

.28 Suspension System for Ceilings:
.1 Standard of Acceptance: Armstrong - Drywall suspension system.

3 Execution

3.1 PARTITION TYPES

.1 Refer to Drawings for partition types.
.2 Provide partitions complete to underside of structure, unless otherwise indicated on Drawings.

3.2 EXAMINATION

.1 Examine substrate for compliance with applicable requirements, installation tolerances and other conditions affecting installation of fibre-reinforced gypsum board or sheathing. Do not proceed until unsatisfactory conditions have been corrected. Beginning of installation shall indicate acceptance of substrate conditions.

3.3 INSTALLATION

.1 Give minimum 48 hours notice for Consultant's inspection of internal wall insulation, vapour barriers and services prior to concealing with gypsum board.
.2 Carry out work using skilled tradesmen carefully supervised by competent foremen.
.3 Take all measurements accurately.
.4 Comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation. Install framing, blocking and furring in accordance with ASTM C645, ASTM C1280.
.5 Maintain wallboard panels minimum 6 mm and maximum 13 mm above floor to prevent moisture transfer.
.6 Extend panels to underside of deck or structure and at fire rated and sound control partitions.
.7 Do taping and filling of concealed surfaces above ceiling line.

.8 Keep end joints away from prominent locations and central portions of ceilings.
.9 Locate vertical joints at least 300 mm from jamb lines of openings.
.10 Space screws for regular wallboard at 300 mm oc along board edges and in board field on walls and ceilings; at fire-rated assemblies, reduce spacings to comply with labelling authorities assembly listings.
.11 For other specialty boards screw spacing shall be in accordance with manufacturer's recommendations.
.12 Drive screws with power screw-gun and set with countersunk heads slightly below surface of board.
.13 Do not secure gypsum board by installing screws into aluminum or steel window and door frames.
.14 At partitions except shaft walls, apply 1 continuous 6 mm bead of acoustical sealant to each side of partition where gypsum board meets dissimilar materials.
.15 Where 2 layers of gypsum board per face are required, apply bead of sealant at perimeter of base layer only.
.16 Apply sealant beads at perimeter of all other services and like objects which penetrate wallboard in accordance with manufacturer's directions.
.17 Install access panels in locations to be determined by coordination with Trades installing mechanical, electrical and other building services.
.18 Consultant reserves right to relocate access panels up to 3600 mm from locations shown on Drawings due to site conditions, providing ample warning is given prior to installation.
.19 Install in accordance with manufacturer's instructions.
.20 Provide access panels in locations and sizes required by other Sections.
.21 Coordinate with other Sections for locations and sizes. Install in accordance with manufacturer's instructions.
.22 At impact resistant gypsum board Provide 0.914 mm (designation thickness 33mils/minimum base steel thickness 0.836 mm (colour - White/20 ga) metal studs. Provide control joints 9000 mm on centre maximum and at both sides of door jambs.
.23 Access Doors and Panels:
.1 Install access doors and panels where required as part of work of this Section in walls, bulkheads, ceilings and soffits.
.2 Cooperate and coordinate delivery of access doors and panels supplied as part of work of Divisions 21, 22. 23. 24 and 26.
.3 Install access doors and panels supplied as part of work of Divisions 21, 22. 23. 24 and 26 in walls, bulkheads, ceilings and soffits.
.24 Shaft Wall:
.1 Construct shaft wall assemblies to provide fire resistance ratings indicated, from both sides, and to maintain airtight seal.
.2 Install shaft wall studs at centres to meet design requirements in accordance with manufacturer's instructions or fire rated test design.
.3 Provide framing to enclose sides, tops and bottoms of shafts terminating at floor or in ceiling space, to maintain fire rating of shaft assembly.
.4 Install shaft wall liner in accordance with manufacturer's instructions at areas where specially designed studs require shaft wall liner panel application as required.
.5 Apply continuous sealant around partitions to ensure airtight shaft enclosures. Firestopping and smoke seals at penetrations specified under Section 07 84 00 - Firestopping.
.6 Where shaft wall height exceeds maximum available panel height, liner panel joints shall be positioned within upper and lower third points of wall and shall be staggered to prevent continuous horizontal joint.
.7 Frame around duct openings through shaft walls with 'J' runners.
.25 Gypsum Board Application:
.1 Provide gypsum board in accordance with manufacturer's written installation instructions and finish to requirements of ASTM C840. Ensure moisture resistant

gypsum board is installed on any wall/partition containing a plumbing fixture (i.e. water closets, sinks, tubs, etc.).

.2 Provide metal trim casing bead at junctions with dissimilar materials.

.3 Provide reveals at junctions with dissimilar materials and where indicated.

.4 Provide curved uniform surfaces by wetting or dampening board or scoring back gypsum board and form to profiles indicated Provide additional screws and framing members to maintain design curve.

.5 Apply joint compound and trowel smooth to provide continuous, smooth radius free from flat spots, facets and trowel marks.

.6 Allow gypsum boards to dry thoroughly before handling.

.7 Provide finished work plumb, level and true, free from perceptible waves or ridges and square with adjoining work.

.8 Cut and fit gypsum board to accommodate or fit around other parts of Work.

.9 Provide work of this Section accurately and neatly.

.10 Butt gypsum board sheets together in moderate contact.

.11 Do not force into place.

.12 Place tapered or wrapped edges next to 1 another.

.13 Provide gypsum board perpendicular to framing and in lengths that will span ceilings and walls without creating end (butt) joints.

.14 If butt joints do occur stagger and locate them as far from centre of walls and ceilings as possible.

.15 Accurately fit exposed butt joints together and make edges smooth.

.16 Support ends and edges on framing.

.17 Fasten gypsum board to furring and studs with screws. Space screws at 200 mm oc at board edges and 300 mm oc on board field. Ensure perimeter screws are not less than 9 mm nor more than 13 mm from edges and ends are opposite screws on adjacent boards.

.18 Gypsum Board - Single Layer:

- .1 Ceilings:
  - .1 Apply gypsum board to metal furring with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members.
  - .2 Space screws at 200 mm oc.
- .2 Partitions:
  - .1 Apply gypsum board to metal studs with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members. Locate vertical joints at least 300 mm from jamb lines of openings. Space screws at 200 mm oc at board edges and 300 mm oc on board field.
- .3 Ceiling and Partition Fasteners:
  - .1 Ensure perimeter screws are not less than 9 mm nor more than 13 mm from edges and ends are opposite screws on adjacent boards. Drive screws with power screw gun and set with countersunk head slightly below surface of board.
- .4 Joints: Finish all joints unless specified otherwise.

.19 Gypsum Board - Double Layer:

- .1 Lay out work to minimize end joints on face layer; to offset parallel joints between face and base layers by at least 250 mm and to apply face layer at right angles to base layer.
- .2 Base Layer: Base layer shall be same as face layer, or backing board, and applied at right angles to framing members. Secure base layer with screws spaced 300 mm oc to each member. Ensure perimeter screws are not more than 13 mm from edges and ends are opposite screws on adjacent boards. Ensure surface of erected base layer is straight, plumb or level and without protrusions before face layer is applied.

.3 Face Layer: Apply face layer at right angles to base layer with adhesive. Apply adhesive with notched spreader to leave 9 mm x 13 mm ribbons, 38 mm apart over entire back side of face layer. Erect board immediately after spreading adhesive. Supplement adhesive with screw fasteners. Provide temporary support for board until adhesive bond has fully developed. As alternative to adhesive specified, joint cement mixed with water in accordance with manufacturer's directions may be used. Allow joint cement and water mixture to stand 30 minutes before using.

.4 Joints: Finish joints in face layers only, unless otherwise required to achieve fire resistant ratings indicated, as hereinafter specified. Setting compound for fire rated construction shall conform to requirements of authorities having jurisdiction to obtain fire rating shown on Drawings.

.26 Gypsum Board Laminated to Concrete and/or Concrete Block Masonry:

.1 Gypsum Board Laminated to Concrete and/or Concrete Block Masonry:

.2 Mix laminating adhesive in accordance with manufacturer's directions.

.3 Allow to stand 30 minutes before using.

.4 Apply adhesive with notched trowel to leave 9 mm x 13 mm ribbons, 32 mm apart over entire back side of face layer.

.5 Erect gypsum board immediately after spreading adhesive.

.6 Use moderate pressure to develop full adhesive contact with substrate.

.7 Temporarily secure gypsum board in place with concrete nails or bracing.

.8 Ensure joints are accurately aligned.

.9 Avoid impact or movement of boards until adhesive sets firmly.

.10 Remove temporary support when adhesive has set.

.11 Do not treat joints of laminated gypsum board for at least 24 hrs after lamination.

.27 Exterior Sheathing:

.1 Provide exterior sheathing in accordance with manufacturer's instructions.

.2 Minimum Fastening Requirements:

.1 Perimeter Edge of Each Board: 200 mm oc max.

.2 Intermediate Supports: 300 mm oc max.

.3 Provide exterior sheathing neatly with tight butt joints and without gaps and holes.

.4 Bear edges of exterior sheathing fully onto structural framing.

.5 Do not crush exterior sheathing edges.

.6 Secure exterior sheathing to exposed leg of inner track of telescopic 2-piece top track.

.7 Provide ready to receive air/vapour barrier membrane.

.28 Interior Ceilings:

.1 Comply with recommendations of CGC Drywall Steel-Framed Systems Folder 09250-SA 923.

.2 Provide hanger wires spaced at maximum 1200 mm oc along carrying channels and within 150 mm of ends of carrying channel runs.

.3 Secure hanger wires to inserts in structure above.

.4 Provide carrying channels maximum 1200 mm oc and within 150 mm of walls.

.5 Secure with hanger wire saddle-tied along channels.

.6 Provide 25 mm clearance between runners and walls.

.7 Provide splicers behind joints. Level channels to a maximum tolerance of 3 mm over 3600 mm.

.8 Provide metal furring channels at right angles to carrying channels at maximum 600 mm oc and within 150 mm of walls.

.9 Provide 25 mm clearance between furring ends and abutting walls.

.10 Attach furring channels to carrying channels with saddle-tie of double strand tie wire.

.11 Provide additional cross-reinforcing at bulkheads and at other openings.

.12 Provide additional reinforcement for ceiling mounted miscellaneous accessories and signage.

.13 Provide ceiling gypsum board, smooth and level.

.29 Metal Trim and Accessories:
- .1 Provide metal trim casing beads at reveals; at ceiling-wall intersections and partition perimeters; and at intersection of dissimilar constructions such as gypsum board to concrete.
- .2 Provide metal trim casing beads where gypsum board abuts against a surface having no trim concealing junction.
- .3 Provide ceiling fascia suspension trims at perimeter of "floating" suspended gypsum board ceilings as indicated on the Drawings.
- .4 Provide a 13 mm separation gasket between metal trim casing beads and window frames or other cold surfaces, where such framing abuts exterior door or window frame.
- .5 Tape shall be either full width or 1 strip 9 mm wide on each side of framing member.
- .6 Provide casing bead where gypsum board abuts materials other than itself and acoustic tile ceilings including at exterior door and window frames, where juncture is not concealed with trim; or elsewhere where indicated on Drawings.
- .7 Unless indicated otherwise, use tape 3 mm narrower than casing bead to provide recess at exposed side. Compress tape by 25%.
- .8 Unless indicated otherwise, use tape 3 mm narrower than casing bead to provide recess at exposed side. Compress tape by 25%.
- .9 Provide prefinished metal angle trim supports and Provide light pockets and eggcrate grilles and/or louvres in accordance with manufacturer's instructions.
- .10 Install light pockets and eggcrate grilles and/or louvre units square, straight and in 1 piece where possible or with inconspicuous joints at long runs.

.30 Control Joints:
- .1 Provide pre-fabricated, pre-manufactured control joints and/or prepared to suit site conditions control joints and in accordance with manufacturer's instructions and in accordance with ASTM C840.
- .2 Set in gypsum facing board, supporting control joints with studs or furring channels on both sides of joint.
- .3 Ensure double studs with discontinuous tracks and double suspended ceiling furring channels have been installed prior to commencing board and bead application at control joints.
- .4 Provide control joints at following locations:
  - .1 Support construction changes.
  - .2 Partition, ceiling or furring runs exceed 9000 mm.
- .5 Provide control joints full height floor to ceiling or door header to ceiling in partitions and furring runs.
- .6 Provide control joints from wall to wall in ceiling areas.
- .7 Provide continuous polyethylene dust barrier behind and across control joints.
- .8 Obtain Consultant's acceptance of exact location of control joints.

.31 Sound Control:
- .1 Where indicated on Drawings, provide sound rated partitions and ceiling in locations indicated to meet required minimum Sound Transmission Class STC rating.
- .2 Gypsum board shall be applied on both sides of sound-proofed partitions.
- .3 Follow manufacturer's details and recommendations.
- .4 Provide sound attenuation insulation to completely fill height of stud cavities.
- .5 Tightly butt ends and sides of blankets within cavities.
- .6 Cut blankets to fit small spaces.
- .7 Carefully fit blankets behind electrical outlets, bracing, fixture attachments and mechanical and electrical services.
- .8 Staple blankets to back of gypsum board as recommended by gypsum board manufacturer.
- .9 At sound attenuating suspended ceiling and enclosures having spring isolator hangers, terminate ceiling or enclosure at adjacent construction by providing continuous isolator strip and sealed joint.

.32 Sealant:

.1 Conform to ASTM C919 for use of sealants in sound attenuation partitions.

.2 Apply acoustical sealant around partition cutouts including, but not limited to, electrical outlets and boxes, plumbing and duct outlets, and other miscellaneous wall and floor penetrations or gaps.

.3 Apply acoustical sealant to every air gap, such as gaps around perimeter of wall, between wall panels and around any penetrations made for plumbing or electrical wiring. Seal off any piping, electrical output boxes, and duct work with acoustical treatments. Treat junction boxes with acoustic putty, treat piping and duct work either with fiberglass duct liner or damping material or both.

.4 Treat frame with gasket material (weather-strip) and install security flap on bottom of door to seal it off.

.5 Apply minimum 13 mm diameter bead of acoustic sealant continuously around periphery of each face of partition to seal gypsum board/structure junction where partitions abut fixed building components in accordance with recommendations of "CGC Drywall/Steel Framed Systems, Folder SA923 09250".

.33 Joint Treatment - Gypsum Board:

.1 Verify board is firm against framing members and screw heads are properly depressed.

.2 Mix joint compound or ready-to-use compounds according to manufacturer's directions. Use pure, unadulterated, clean water for mixing.

.3 Permit mixed material to stand 30 minutes before using.

.4 Do not mix more material than can be used within 1 hour.

.5 Do not use set or hardened compound.

.6 Clean tools and equipment after mixing each batch.

.7 Tape and fill joints and corners in accordance with gypsum board manufacturer's printed instructions.

.8 Fill either manually, using hand tools of trade, or by a mechanical taping and filling machine of proven efficiency.

.9 Remove plastic tape from control joints after finishing with joint compound.

.10 After final coats of filler have dried at least 24 hours, sand surface lightly with No. 00 sandpaper to leave it smooth, ready for decoration.

.11 Provide finished work smooth, seamless, plumb and true, flush and with square plumb neat corners.

.12 Levels of Finish: Provide following levels of finish in accordance with ASTM C840:

.1 Level 0: No taping, finishing or accessories required for temporary construction or areas where final decoration is not required.

.2 Level 1: Use this level in plenum areas above ceilings, attics, areas where assembly would generally be concealed or in building service corridors and other areas.

.3 Level 2: Use this level where water resistant gypsum backing board (ASTM C630M) is used as substrate for tile; may be used in garages, warehouse storage, or other similar areas where surface appearance is not of primary concern.

.4 Level 3: Use this level in appearance areas which are to receive heavy or medium texture spray or hand applied finishes before final painting or where heavy grade wall coverings are to be applied as final decoration.

.5 Level 4: Use this level where light textures or wall coverings including paint are to be applied.

.6 Level 5: Use this level to provide a uniform surface and minimize possibility of joint telegraphing and of fasteners showing through final decoration. Use this Level of finish when using gloss, semi-gloss or enamel paint finish or when working in a critical (severe) lighting areas including but not limited to walls and ceiling areas near windows, skylights, long hallways and atriums with

large surface areas exposed to artificial and natural light. Refer to ASTM C840 for additional locations for Level 5 applications.

.7 Exposed Moisture Resistant Gypsum Board Joint Finish: All joints and interior angles shall have fiberglass tape embedded in setting 90 joint compound and 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles. Cover fasteners heads and accessories with three (3) separate coats of joint compound. Ensure surface is smooth and free of tool marks and ridges.

3.4 FIRE RATED PARTITIONS

.1 Ensure materials for fire rated construction conform to requirements of Authorities Having Jurisdiction to obtain fire rating shown on Drawings.

.2 Where dissimilar components are built into fire rated assemblies ensure continuity of fire separation by boxing in elements with gypsum board and framing to suit Authorities Having Jurisdiction.

.3 Work in cooperation with Section providing firestopping work.

.4 Provide fire rated enclosures, separations and assemblies as indicated on Drawings conforming to requirements of Authorities Having Jurisdiction.

.5 Where required, secure sound attenuation blanket insulation between studs as specified in Article on Sound Control Partitions.

3.5 CUTTING AND PATCHING

.1 Cooperate and coordinate with other Sections to obtain satisfactory gypsum board finish work. Do all cutting, patching and make good as required by installation of work of other Sections.

3.6 CLEANING

.1 Clean off beads, casings, joint cement droppings and similar items and remove surplus materials and rubbish on completion and as directed.

3.7 FIRE WALL IDENTIFICATION

.1 Following installation of gypsum board and painting.

.2 Provide identification on fire walls.

.3 Using three (3) stencils cut out to read "Smoke Sealed", "1-Hour Fire Rated" and "2-Hour Fire Rated" in 75mm high letters.

.4 Using stencil and spray can of paint to transfer the information to the appropriate walls above the ceiling level at 3000 mm o/c on both sides of wall.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 53 - Miscellaneous Rough Carpentry
.2 Section 07 21 16 - Blanket Insulation
.3 Section 07 26 00 - Vapour Retarders
.4 Section 08 11 13 - Hollow Metal Doors and Frames.
.5 Section 09 21 16 - Gypsum Board Assemblies
.6 Division 10 - Specialties
.7 Division 23 - Heating, Ventilation and Air Conditioning (HVAC)
.8 Division 26 - Electrical

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM C645-00, Specification for Nonstructural Steel Framing Members.
  .2 ASTM C754-00, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

1.3 SUBMITTALS

.1 Shop Drawings:
  .1 Submit shop drawings including fabrication and erection documents and materials list inaccordance with Division 01 - General Requirements.
  .2 Include on Shop Drawings, all connection details, stud and track gauges.
  .3 Each shop drawing submitted shall bear stamp and signature of qualified professional engineer registered or licensed to practice in the Province of Prince Edward Island, Canada.

1.4 QUALITY ASSURANCE

.1 Execute Work of this section by a Contractor who has adequate plant, equipment and skilled tradesman to perform it expeditiously, and who has been responsible for satisfactory installations similar to that specified, during a period of at least the immediate past three (3) years.
.2 Attend pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 NON-LOAD BEARING WALL FRAMING

.1 Non-load bearing channel stud framing: to ASTM C645, stud sizes as noted on drawings, roll formed from 0.84 mm (20 gauge) thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centers.
.2 Deflection for interior stud walls to be L/240 maximum.
.3 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.
.4 Metal channel stiffener: 13 x 38 mm size, 1.4 mm (18 gauge) thick cold rolled steel, coated with rust inhibitive coating.

.5 Acoustical sealant: to CAN/CGSB-19.21 to perimeter of walls with acoustic insulation.
.6 Insulating strip: rubberized, moisture resistant 3 mm thick foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.
.7 Wall Reinforcement metal blocking: 14 ga. X 610 mm wide galvanized metal sheet reinforcement to ASTM A924 at locations including, but not limited to the following:
    .1 All washroom accessories.
    .2 Lockers.
    .3 Wall-mounted door stops.
    .4 All other wall-mounted specialties, including Owner-supplied items.

2.2 STEEL STUDS

.1 Steel Studs:
    .1 ASTM C645, Galvanized sheet steel, minimum 0.531 mm (designation thickness 18mils/minimum base steel thickness 0.836 mm/colour-White/20 ga) thickness, zinc coating Z275, screw able with crimped web and returned flange, of depth shown in maximum continuous lengths practicable.
    .2 Provide heavier gauges where required due to height.
.2 Heavy Duty Studs at Openings and Unrestrained Height:
    .1 ASTM C645, Galvanized sheet steel, minimum 1.087mm, 18ga thickness, zinc coating Z275, screw able with crimped web and returned flange, of depth shown in maximum continuous lengths practicable.
    .2 Provide heavier gauges where unrestrained height exceeds 3600 mm.
.3 Concealed Reinforcement in Partitions:
    .1 Sheet Steel Reinforcing in Partitions:
        .1 Commercial quality cold rolled galvanized sheet steel to ASTM A653M with zinc coating designation of ASTM A653M, Z275 in minimum thickness of 1.087 mm /colour-yellow/18 ga).
        .2 Must be specially treated by phosphate conversion process if steel is to be exposed and finish painted.
        .3 Concealed Structural Shapes, Plates, Reinforcements: 3 mm new material conforming to CSA G40.20 and CSA G40.21, Grade 300W. Hot dipped galvanizing with minimum zinc coating of 600 g/m2 to CAN/CSA-G164-M.
    .2 Concealed Knee Brace for Low Wall Partitions:
        .1 Concealed welded steel assembly made up of 50 mm x 50 mm tube and 3 mm wall and 88 mm x 127 mm x 9 mm base plate with 4 holes 10 mm diameter.
        .2 Assembly shall be provided with flat black primer to yield corrosive resistant surface compatible with joint compounds and interior finishes.
        .3 Height to suit low wall partitions.
        .4 SKB Knee Brace Kit by Pittcon Softforms Corp.
        .5 Provide hollow structural steel, stud, angle and steel plate sections, galvanized sheet steel minimum 1.214 mm (designation thickness 43mils/minimum base steel thickness 1.087 mm /colour-yellow/18 ga) where required to support manufactured components.
        .6 Weld connections.
.4 Provide knockout openings in web at 460 mm oc to accommodate (if required) horizontal mechanical and electrical service lines and bracing.
.5 Floor and Ceiling Partition Track for Gypsum Board:
    .1 ASTM C645, Galvanized sheet steel, 0.836 mm /colour-White/20 ga) overall thickness zinc coating Z275, with minimum 30 mm legs, top track having longer legs where required to compensate for deflection of structure above.
    .2 Width to suit metal studs.
.6 Furring Channels:

.1 Galvanized sheet steel, minimum 0.914 mm (designation thickness 33mils/minimum base steel thickness 0.836 mm /colour-White/20 ga) overall thickness zinc coating Z275 screw channels, 67 mm wide x 22 mm deep.

.7 Carrying Channels for Gypsum Board:

.1 ASTM C645, galvanized sheet steel, minimum 1.214 mm (designation thickness 43mils/minimum base steel thickness 1.087 mm /colour-yellow/18 ga) overall thickness zinc coating Z275, 38 mm high with 19 mm flanges, for primary carrying member in suspended ceilings and as horizontal stiffeners or bracing in metal stud systems.

3 Execution

3.1 ERECTION NON-LOAD BEARING WALL FRAMING

.1 Align partition tracks at floor and ceiling and secure at 600 mm o.c. maximum.

.2 Install dampproof course under stud shoe tracks of partitions on slabs on grade.

.3 Place studs vertically at 400 mm o.c. and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.4 Erect metal studding to tolerance of 1:1000.

.5 Attach studs to bottom track using screws. Do not fix top of studs to ceiling track.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centers specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.9 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs. For door widths greater than 1219 mm, incorporate diagonal braced stud at head of opening.

.10 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.11 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.12 Extend all partitions to underside of deck above except where noted otherwise on drawings. Where partitions occur under and parallel to ductwork, provide steel stud frames around ductwork to secure partition head. Maintain 12 mm clearance between ductwork, piping or equipment which might transmit vibration to metal framing.

.13 Maintain 19 mm clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 88 mm leg ceiling tracks.

.14 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.15 Install two lines of stiffeners in partitions up to 2440 mm high and three lines in partitions over 3660 mm high. Install stiffeners snugly in knock out service holes, extended horizontally across entire length of each braced partition and across two full stud spaces at each side of door and screen openings. Wire stiffeners at splices.

.16 Install metal blocking for the attachment of accessories and equipment as required by individual sections and drawings. Blocking to be sized to suit vertically a minimum of 150 mm higher, 150 mm lower than the attachment points and horizontally a minimum of one stud beyond attachment point each way.

.17 Provide and install 18ga wall reinforcement metal sheet on all washroom walls secured to 'flanges' of steel studs with sheet metal screws. Locate bottom of metal sheet at 600 mm AFF.

.18 Install 75mm X 75mm metal angle blocking vertically to all non-90° corners for full height to 150 mm above ceiling and to all corners designated to receive corner guards for height of guard.
.19 Conform to manufacturer recommendations for installation of fire dampers.
.20 Provide diagonal bracing at maximum 1220mm o.c. at large door and screen openings 1200mm and wider in interior partitions between top of frame and floor structure above.

3.2 INSTALLATION

.1 Metal Framing for Partitions and Bulkheads:
  .1 Comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation and recommendations of CGC Drywall Steel-Framed Systems for metal stud partition, ceiling, column fireproofing and bulkhead detailing.
  .2 Install members true to lines and levels and to maintain surface flatness with maximum variation of 3 mm in 300 mm in any direction.
  .3 Provide partition tracks at floor and underside of ceiling or structure above.
  .4 Align accurately. Lay out to partition layout.
  .5 Curved partitions: Erect partial height and curved partitions as indicated.
  .6 Cut top and bottom runners through leg and web at 50 mm intervals for arc length.
  .7 Bend runners to uniform curve of radius indicated and locate straight lengths tangent to arcs. Support outside (cut) leg of runners by clinching a 25 mm high x 0.914 mm (designation thickness 33mils/minimum base steel thickness 0.836 mm /colour-White/20 ga)thick sheet steel strip to inside of cut legs using metal lock fasteners.
  .8 Attach studs to runners with 9.5mm long pan head framing screws.
  .9 On straight lengths at ends of arcs, place studs 150 mm on center with last stud left free standing.
  .10 Place studs vertically at 400 mm oc unless otherwise specified, not more than 50 mm from abutting walls, and at each side of openings and corners.
  .11 Position studs in tracks.
  .12 Cross brace studs as required to provide rigid installation.
  .13 Provide heavy duty double boxed studs at each side of openings to extend in 1 piece from floor to underside of structure above.
  .14 Co-ordinate erection of studs and installation of service lines.
  .15 Provide continuous gasket to separate metal framing from masonry and concrete.
  .16 Do not secure studs to exterior window framing, or to ceiling grid members.
  .17 Provide continuous gasket between ceiling and floor tracks, and structure.
.2 Concealed Reinforcements in Partitions:
  .1 Provide concealed steel reinforcing in gypsum board partitions where scheduled on Drawings or required to meet design requirements which may include without limitations, concealed hot dipped galvanized structural shapes, plates reinforcements and concealed knee brace for low wall partitions.
  .2 Ensure rigid and secure installation capable of offering resistance to minimum 227 kg pull force.
  .3 Provide continuous horizontal furring channels as backing to wall cabinets.
  .4 Galvanize stud reinforcements in moist areas.
  .5 Do not use wood blocking for this purpose.
  .6 Provide additional reinforcing framing studs, backer plates or furring channels secured between studs for attachment and support without limitations following:
    .1 Washroom accessories.
    .2 Fire hose cabinets.
    .3 Access panels.
    .4 Architectural woodwork.
    .5 Miscellaneous specialties including but not limited to:
      .1 Corner guards.
      .2 Continuous handrailing.

.3 Chair railing.
.4 Bumper railing.
.5 Baby change station.
.6 Coat rack.
.7 Wall mounted lights.
.8 Fitments and fixtures.
.9 System furniture
.10 Equipment.
.11 Wall mounted equipment.

.3 Access Doors and Panels:
  .1 Install access doors and panels where required as part of work of this Section in walls, bulkheads, ceilings and soffits.
  .2 Cooperate and coordinate delivery of access doors and panels supplied as part of work of Divisions 21, 22. 23. 24 and 26.
  .3 Install access doors and panels supplied as part of work of Divisions 21, 22. 23. 24 and 26 in walls, bulkheads, ceilings and soffits.

.4 Metal Furring:
  .1 Erect furring in accordance with manufacturer's directions and as specified herein.
  .2 Provide furring rigid, secure, square, level or plumb, framed and erected to maintain finish dimensions and contours indicated.
  .3 Allow for thermal movement.
  .4 Furr around ducts, pipes and dropped beams occurring in finished areas and for vertical gypsum board breaks within or at termination of ceilings.
  .5 Provide metal furring channels fastened to masonry or concrete surfaces in parallel rows at 400 mm oc unless gypsum board is indicated to be adhered directly to masonry or concrete surfaces. Shim metal furring channels to provide a level surface.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 21 16 - Gypsum Board Assemblies: Suspension systems for gypsum board ceilings.
.2 Section 09 51 00 - Acoustical Ceilings.
.3 Division 23 - HVAC, trim for recessed mechanical fixtures.
.4 Section 26 50 00 - Lighting.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM C423-02a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  .2 ASTM E1264-98, Standard Classification for Acoustical Ceiling Products.
  .3 ASTM E1477-98a(2003), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
  .4 ASTM C635M-07 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
  .5 ASTM C636M-06, Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
  .6 ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
  .7 ASTM E1264 Standard Classification for Acoustical Ceiling Products.
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction and Amendment No. 1 1988.
  .2 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.
  .3 CAN/ULC-S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
  .4 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.
  .5 CAN/ULC S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
  .6 CAN/ULC-S702-97, Standard for Mineral Fibre Thermal Insulation for Buildings
.3 Underwriter's Laboratories of Canada (ULC)
  .1 CAN/ULC-S102-2003, Surface Burning Characteristics of Building Materials and Assemblies.
.4 Ceilings and Interior Systems Construction Association (CISCA):
  .1 CISCA Code of Practices.

1.3 DESIGN REQUIREMENTS

.1 Design all systems for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority. Systems are not designed to carry the weight of electrical equipment.
.2 Suspension Systems:
  .1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.
  .2 Design ceilings to resist safely and effectively all loads and effects of loads in accordance with part 4.0 of the National Building Code.
  .3 Design ceiling suspension systems in accordance with ASTM C636, ASTM C754 and manufacturer's printed directions.
  .4 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

.5 Design suspension system to support weight of mechanical and electrical items such as air handling boots and lighting fixtures, and with adequate support to allow rotation/relocation of light fixtures.
.6 Acoustic panel system is not designed to carry the weight of mechanical and electrical equipment.
.7 Design sub framing as necessary to accommodate, to circumvent, and to avoid conflicts and interferences where ducts or equipment prevent regular spacing of hangers.

.3 Coordinate installation and cooperate with Mechanical and Electrical Subcontractors, to accommodate mechanical and electrical items, or any other work required to be incorporated in or coordinated with the ceiling system.

1.4 SUBMITTALS

.1 Make all submittals in accordance with Division 01 - General Requirements.
.2 Shop Drawings:
.1 Submit suspension and acoustic panel systems layouts - include bulkheads, hangers, supports, carriers, and panel sizes, locations patterns and termination at walls.
.2 Indicate insert and hanger spacing and fastening details, location of mechanical and electrical components, splicing method, and details of changes in level and junctions with dissimilar materials.
.3 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.
.4 Submit conditions at abutting, intersecting, and penetrating construction.
.5 Submit dimensioned locations of lighting fixtures, diffusers, sprinkler heads, P.A. system speakers, and other items that pierce the ceiling plane.
.3 Product Data:
.1 Submit manufacturer's technical literature and installation instructions describing components, materials and finishes.
.4 Material Safety Data Sheets:
.1 Submit MSDS for inclusion in Operation and Maintenance Manual.
.5 Samples:
.1 Submit one representative model of each type ceiling suspension system.
.6 Certificates:
.1 Submit written certification stating that suspended ceiling systems are designed for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority.
.2 Submit independent test data and certificate confirming system meets or exceeds specified STC rating.
.3 Submit independent test data and design tables for each type of insert to be employed on this project for hanger supports.

1.5 REGULATORY REQUIREMENTS

.1 Fire-resistance rated suspension system: certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.6 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Division 01 - General Requirements.
.2 Provide extra suspension system materials in unopened clearly marked cartons of 12 pieces each of 1220mm long tees and 610mm long tees.
.3 Extra materials to be from same production run as installed materials.
.4 Deliver to site, upon completion of the Work of this Section.
.5 Store where directed by Consultant

1.7 WARRANTY

.1 Submit a written warranty executed by the manufacturer, agreeing to repair or replace grid system components that fails within the warranty period. Failure includes but not limited to:
  .1 Rusting and manufacturer defects.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MATERIALS

.1 Intermediate Grid System. Unless otherwise indicated, ceiling suspension products shall be manufactured to minimum requirements of ASTM C635, for Heavy Duty, modified as required to suit grid design shown.
.2 Exposed Grid System:
  .1 Factory finished satin white on hot dipped galvanized cold rolled steel.
  .2 Acceptable Material: Refer to Material / Finish Schedule.
.3 Basic Steel Material and Finish:
  .1 Commercial quality cold rolled steel 0.179" (26 ga) minimum thickness, and heavier gauge for Heavy Duty as necessary, galvanized to zinc coating designation Z275.
  .2 Exposed surfaces of metal Products shall be factory finished in non-yellowing, low sheen satin white enamel to Consultant's acceptance to match whiteness in panels.
  .3 Provide paint formulation of grid system to lighting fixture, speaker grille, sprinkler and diffuser manufacturers to ensure consistency of colour, sheen and texture of all exposed metal components in the ceiling assemblies.
  .4 Provide slip-on trim mouldings or metal mouldings with baked enamel finish, as standard with grid manufacturer, to trim around light fixtures.
.4 Accessories for Suspension System:
  .1 Complete with splices, clips, and perimeter moulding, of manufacturer's standard and aluminum types to suit the applicable conditions unless special conditions and access areas are shown or specified.
  .2 In high humidity areas provide galvanized suspension system.
.5 Hangers:
  .1 Minimum 0.104" (12 ga) overall thickness galvanized steel wire to zinc coating designation Z275, meeting "Heavy-duty" classification of ASTM C635.
.6 Main Tees:
  .1 3.66 m long, 23.8 mm face width double web design, rectangular bulb at top of web, 38 mm web height.
  .2 Expansion cut-outs in main tees controlling buckling caused by heat expansion.
.7 Main Tee Splices:
  .1 Designed to lock lengths of main tees together so that joined lengths of tee function structurally as single unit with tee faces at joint perfectly aligned and presenting tight seam.
.8 Cross Tees:
  .1 1220 mm long, 25 mm web height structural cross-section, design same as main tees, designed to connect at main tees forming positive lock without play, loss or gain in grid dimensions with offset over-ride of face flange over main tee flange to provide flush joint.
  .2 Provide 38 mm web height of cross-tee for fire rated assemblies.
.9 Edge Moulding Around Ceiling Perimeters:

.1 Materials and finish to match tees.

.10 Metal Closures and Trim:

.1 Bonderized and with factory-applied white baked enamel finish.

.2 Provide anchors as standard with manufacturer.

.11 Suspended GWB Ceiling System:

.1 Where "GWB" is indicated under ceiling material on finish schedule.

.2 Acceptable Material:

.1 CGC - Drywall suspension system.

.2 Armstrong - Drywall suspension system.

3 Execution

3.1 INSTALLATION

.1 Installation: in accordance with ASTM C636 except where specified otherwise.

.2 Install suspension system to manufacturer's instructions and Certification Organizations tested design requirements.

.3 Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant.

.4 Secure hangers to overhead structure using attachment methods as indicated.

.5 Install hangers spaced at maximum 1200 mm centers and within 150 mm from ends of main tees.

.6 Lay out center line of ceiling both ways, to provide balanced borders at room perimeter.

.7 Ensure suspension system is coordinated with location of related components.

.8 Install wall molding to provide correct ceiling height.

.9 Completed suspension system to support super-imposed loads, such as lighting fixtures and speakers.

.10 Support at light fixtures with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.11 Interlock cross member to main runner to provide rigid assembly.

.12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.

.13 Install access splines to provide 10 percent ceiling access.

.14 Finished ceiling system to be square with adjoining walls and level within 1:1000.

3.2 CLEANING

.1 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 21 16 - Blanket Insulation.
.2 Section 09 22 26 - Suspension Systems.
.3 Mechanical Divisions
.4 Electrical Divisions

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  .2 ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  .3 ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
  .4 ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  .5 ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
  .6 ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
  .7 ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
  .8 ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
  .9 ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.
    .1 Armstrong Fire Guard Products.
  .10 ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint.
  .11 ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.
  .12 ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
  .13 ASTM E 1264 Classification for Acoustical Ceiling Products.
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction and Amendment No. 1 1988.
  .2 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.
  .3 CAN/ULC-S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
  .4 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.
  .5 CAN/ULC S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
  .6 CAN/ULC-S702-97, Standard for Mineral Fibre Thermal Insulation for Buildings
.3 Underwriter's Laboratories of Canada (ULC)
  .1 CAN/ULC-S102-2003, Surface Burning Characteristics of Building Materials and Assemblies.
.4 Ceilings and Interior Systems Construction Association (CISCA):
  .1 CISCA Code of Practices.

1.3 SUBMITTALS

.1 Make all submittals in accordance with Division 01 - General Requirements.

.2 Shop Drawings:

- .1 Submit acoustic panel systems layouts - include bulkheads and panel sizes, locations patterns and termination at walls.
- .2 Indicate insert and hanger spacing and fastening details, location of mechanical and electrical components, splicing method, and details of changes in level and junctions with dissimilar materials.
- .3 Submit conditions at abutting, intersecting, and penetrating construction.
- .4 Submit dimensioned locations of lighting fixtures, diffusers, sprinkler heads, sound system speakers, patient lifts, microscope, operating lights and other items that pierce the ceiling plane.

.3 Product Data:

- .1 Submit manufacturer's technical literature and installation instructions describing components, materials and finishes.

.4 Material Safety Data Sheets:

- .1 Submit MSDS for inclusion in Operation and Maintenance Manual.

.5 Samples:

- .1 Minimum 300mm x 300mm samples of specified acoustical panel. Submit duplicate full size samples of each type acoustical units.
- .2 Submit one full-size sample of each type of tile panel to be used.

.6 Certificates:

- .1 Submit written certification stating that suspended ceiling systems are designed for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority.
- .2 Submit certificate attesting installed acoustical ceiling systems meet fire resistance ratings required for this project.
- .3 Submit independent test data and certificate confirming system meets or exceeds specified STC rating.
- .4 Submit independent test data and design tables for each type of insert to be employed on this project for hanger supports.

1.4 DESIGN REQUIREMENTS

.1 Performance Requirements:

- .1 Provide acoustical ceiling assembly designed and tested to provide surface burning characteristics (ASTM E84) as follows:
  - .1 Flame Spread: 0.
  - .2 Smoke Development: 0.
- .2 Provide acoustical ceiling system which has been manufactured, fabricated and installed to provide Noise Reduction Coefficient (NRC) rating.

.2 Design all systems for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority. Systems are not designed to carry the weight of electrical equipment.

1.5 QUALITY ASSURANCE

.1 Applicator Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.6 COORDINATION OF WORK

.1 Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.7 REGULATORY REQUIREMENTS

.1 Fire resistance: NFPA Class A fire retardant treated wood required by code, to conform to ASTM E84.

1.8 MOCK-UP

.1 Construct mock ups in accordance with Division 01 - General Requirements.
.2 Construct mock-up 10 square meters minimum of each type acoustical tile ceiling including one inside corner and one outside corner.
.3 Construct mock-up where directed.
.4 Allow 24 hours for inspection of mock-up by Consultant before proceeding with ceiling work.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 The building shall be enclosed, the air conditioning system shall be operating with proper filters in place, and the proper temperature and humidity conditions shall be established before, during, and following installation.
.2 Building areas to receive ceilings shall be free of construction dust and debris.
.3 Do not install the Work of this Section until:
    .1 Mechanical and Electrical Work above the ceiling is complete.
    .2 Maintain uniform humidity of 20-40% before and during installation.
    .3 Ventilation is adequate to remove excess moisture.
    .4 Uniform Temperature 13-21 degrees C.
.4 Permit wet work to dry before commencement of installation.
.5 Store materials in work area 48 hours prior to installation.
.6 Areas are closed and protected against weather and maintained at no less than 10 degrees C.

1.10 DELIVERY, STORAGE, AND HANDLING

.1 Transport, handle and store material in manner to prevent warp, twist, and damage to panel edges and surfaces in accordance with Manufacturer's recommendations.
.2 Any bent, twisted, warped, or otherwise damaged tee grid suspension components, panels, and or trim shall not be used under any circumstances. Replace such damaged items with new straight, undamaged and acceptable material at no cost to Owner.
.3 Store material in warm, dry place away from water and the elements. Protect against undue loading stresses and shock.
.4 All packaged material shall be delivered in original manufacturer's wrappers and containers with labels and seals intact. Cartons for all fire rated materials shall bear U.L label.

1.11 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Division 01 - General Requirements.
.2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type specified to nearest full carton, minimum two cartons.
.3 Extra materials to be from same production run as installed materials.
.4 Clearly identify each type of acoustic unit, including color and texture.
.5 Deliver to site, upon completion of the Work of this Section.
.6 Store where directed by Consultant

1.12 WARRANTY

.1 Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replacement of acoustical panels that falls within the Warranty period. Failure include, but are not limited to:
    .1 Acoustical Panels: Sagging or warping
    .2 Grid System: Rusting and manufacturers defects

.2 Warranty period for acoustical panels is ten (10) years from date of Substantial Completion.
.3 The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.13 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 ACOUSTICAL CEILING PANELS

.1 Acceptable material: Refer to Material / Finish Schedule.

3 Execution

3.1 INTERFACE WITH OTHER WORK

.1 Co-ordinate with Section 07 21 16 - Blanket Insulation and 09 22 26 - Suspension Systems.
.2 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

3.2 EXAMINATION

.1 Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities and dampness that would affect quality and execution of work.
.2 Do not proceed with installation of ceiling system until unacceptable conditions are corrected.

3.3 MANUFACTURER'S INSTRUCTIONS

.1 Comply with the instructions and recommendations of the ceiling system manufacturer.
.2 Install materials in accordance with governing regulations, fire resistance rating requirements and industry standards applicable to work.
    .1 Comply with CISCA Code of Practices.

3.4 INSTALLATION

.1 General: Do not begin installation until materials sufficient to complete an entire room are received and prepared for installation.
.2 Ensure wet work is completed and dried out to a degree acceptable to panel manufacturer before installation is commenced. Maintain uniform temperatures of at least 21°C for 72 hours prior to commencement of work and maintain temperature until 72 hours after completion.
.3 Install ceiling panels and metal suspension system in accordance with applicable requirements of ASTM C636 and manufacturer's directions.
.4 Where manufacturer's directions are at variance with Contract Documents, notify Consultant before proceeding with work.
.5 Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders.
.6 Recessed items shall replace or be centred on acoustical panels, except where shown otherwise.
.7 Consult with Mechanical and Electrical Divisions to co-ordinate work.
.8 Provide additional supports where required.

.9 Space hangers for suspended ceilings to support grillage independent of walls, columns, pipes and ducts at maximum 1220mm centres along support grillage and not more than 150mm from ends.

.10 Provide additional hangers at light fixtures and diffusers.

.11 Attach hangers to inserts in overhead concrete slab. Bend top of hangers at right angles, turn down and securely fasten. Turn bottom of hangers upwards and securely wrap 3 times.

.12 Suspension to Metal Deck:

- .1 Punch lower part of metal deck with special puncher at required distances.
- .2 Put hanger wire through holes, turn down, make a loop and securely wrap 3 times

.13 Provide written confirmations to Mechanical and Electrical Divisions that suspended ceiling is capable of supporting additional weight of mechanical and electrical fixtures specified in Mechanical and Electrical Divisions.

.14 Run main tees at right angles to length of light fixtures.

.15 Space main tees 1220mm oc in 1 direction and securely tie to hangers.

.16 Space cross tees 610mm oc at right angles to main tees and properly lock at intersections.

.17 Level suspended systems with a maximum tolerance of 3mm over 3m.

.18 Use longest practical lengths of tees, furring and running channels to minimize joints.

.19 Make joints square, tight, flush and reinforced with concealed splines.

.20 Assemble framework to form a rigid and interlocking system.

.21 Design suspension system to accommodate movement caused by thermal expansion or contraction.

.22 Design and space hangers and carrying members to support entire ceiling system, including lighting fixtures, diffusers and equipment openings in locations indicated on reflected ceiling drawings and related Mechanical and Electrical Division drawings.

.23 Use edge moulding where ceiling abuts vertical surface.

.24 Use corner moulding along external edges at ceiling steps.

.25 Install direct-hung exposed grid lay-in acoustic panel ceilings where shown.

.26 Install main tees, cross tees, and wall mouldings so bottom flanges are in flat, level plane at finish ceiling elevations.

.27 Arrange grid so opposite wall edge panels are of equal width but not less than 1/2 panel width and lay out and erect grid system to provide following panel pattern as shown:

- .1 Pattern of 2'-0" x 4'-0" with main beam tees spaced 4'-0" oc and cross tees 2'-0" oc unless reviewed otherwise (imperial measure).
- .2 Pattern of 2'-0" x 2'-0" with main beam tees spaced 2'-0" oc, primary cross tees at 2'-0" oc and secondary cross tees at 610 mm oc (imperial measure).

.28 Erect main beams parallel to main wall and to each other; space uniformly at centres specified. Stop ends of main beams 13 mm from walls allowing for expansion.

.29 In ceilings having recessed lighting fixtures, modify grid framing to provide main beams along and parallel to both long sides of lighting fixtures; at each 300 mm wide fixture.

.30 Provide an additional main beam along the long side of fixture. At other items recessed in ceiling and designed to be framed by main beams, provide additional main beams necessary.

.31 Rest ends of main beams on horizontal leg of wall mouldings.

.32 Support main beams with hangers along each run, spaced at not more than 1220mm centres; except in areas of steel framing, provide hangers at each intersection of main beam and framing.

.33 If ductwork or equipment located in ceiling plenum area interferes with hanger spacing, provide a trapeze or other arrangement reviewed by Consultant to support main beams at proper spacing.

.34 Do not secure hangers to metal roof deck, ductwork, conduit, piping, equipment or support system for any of these.

.35 Provide an additional hanger at each corner of each opening to receive a recessed lighting fixture and each opening that has been framed by main beam members.

.36 Provide additional hangers at each diffuser, grille and other points of extra loading.

.37 Secure hangers to main beams to develop full strength of hangers and per manufacturer's published directions.

.38 Install primary cross tees at right angles to main beam tees and space uniformly at centres specified. Join ends of cross tees to web of main beams with a positive interlock; except at light fixtures, secure members together with concealed steel clips and bolts.

.39 Field paint cut edges to match surface color and sheen.

.40 Arrange acoustical units and orient directionally patterned units, if any, in manner shown on reflected ceiling plans.

.41 Clip down acoustic panels at fire rated rooms or at locations shown on Room Finish Schedule against wind uplift.

3.5 CLEANING

.1 Clean exposed surfaces of acoustical ceilings, trim, edge moldings and suspension members to comply with manufacturer's instructions for cleaning.

.2 Touch up any minor finish damage.

.3 Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.6 PROTECTION

.1 Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 07 92 00 - Joint Sealants.
.2 Section 09 65 19 - Resilient Tile Flooring.

1.2 REFERENCES

.1 ASTM F1861-02 - Standard Specification for Resilient Wall Base.
.2 CAN/CSA-A126.5-87, Resilient Wall Base.
.3 ASTM F2170-02 -Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.3 SUBMITTALS

.1 Make submittals in accordance with Division 01 - General Requirements.
.2 Product Data:
  .1 Submit manufacturer's literature, data sheets for each type of material provided under this Section for Project.
  .2 Data sheets shall provide all required information.
  .3 Submit required copies of detailed instructions for maintaining, preserving and keeping materials in clean and safe conditions and give adequate warning of maintenance practices or materials detrimental to specified materials.
  .4 Submit manufacturer's installation instructions.
.3 Data sheets:
  .1 Submit manufacturer's data sheets for each type of resilient base, resilient base adhesive, surface fillers and primers.
  .2 Data sheets shall provide all required information.
.4 Material Safety Data Sheets:
  .1 Submit MSDS for inclusion in Operation and Maintenance Manual for adhesives and sealants.
.5 Samples:
  .1 Submit duplicate 610 mm long sample of each type of resilient bases.
.6 Operating and Maintenance Instructions Manual:
  .1 Provide maintenance data for resilient bases for incorporation into maintenance manual specified in Division 01 - General Requirements.

1.4 QUALITY ASSURANCE

.1 Qualifications:
  .1 Surface burning characteristics to CAN/ULC-S102.2-M. Flame Spread 25 or less; Smoke Developed 50 or less.
.2 Applicator Qualifications:
  .1 Provide work of this Section executed by competent installers with minimum of 5 years experience in application of products, systems and assemblies specified, including 2 years in heat welding of seams and with approval and training of the product manufacturers.
  .2 Upon request, provide proof of manufacturer's certificate to Consultant prior to commencement of installation.
.3 Pre-Construction Meeting:
  .1 Prior to start of work, arrange for project site meeting of all parties associated with work of this Section, including Contractor, resilient base installer, trade or substrates to which flooring is applied and manufacturer's representative.
  .2 Review Specification for work included under this Section and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence

and quality control, project staffing, restrictions on areas of resilient base installation and other matters affecting construction, to permit compliance with intent of this Section.

.4 Site Sample Mock-Up Area:
- .1 Install minimum 3600 mm long sections of each type of resilient base as directed at the site by Consultant.
- .2 Do not proceed with resilient base work until quality control Mock-Up has been reviewed and accepted by Consultant.
- .3 Reviewed and accepted quality control Mock-Up shall be retained and serve as minimum acceptable standard for the resilient base work.
- .4 Quality control Mock-Up shall be incorporated into finished resilient base work if so accepted by Consultant.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in good condition to site in manufacturer's original unopened containers that bears name and brand of manufacturer, project identification, shipping and handling instructions.

.2 Store on site in designated space at minimum temperature of 20 deg C for period of 48.

1.6 PROJECT CONDITIONS

.1 Provide each flooring Product in accordance with manufacturer's recommended tolerances for:
- .1 Substrate moisture content.
- .2 Temperature and ventilation.
- .3 Maintain Relative Humidity at application to % recommended by manufacturer when tested in accordance with ASTM F2170, Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

.2 Environmental Requirements: Air temperature and structural base temperature at base installation are shall be above 20 deg C for 72 hours before, during and 48 hours after installation.

.3 Allow base materials and application adhesives to acclimatize to these temperatures for 48 hours.

1.7 WARRANTY

.1 Warranty resilient bases for a period of three (3) years from date of Substantial Performance of the Work against defects and/or deficiencies in accordance with General Conditions of the Contract.

.2 Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

.3 Defects include but are not limited to; failure in adhesive bond and extensive colour fading.

1.8 MAINTENANCE MATERIALS

.1 Extra Materials: Supply to Owner at completion of job 6000 mm of coil stock of each type of resilient base in colours specified for future repairs, boxed in original containers and clearly labeled.

.2 Extra stock shall be same production run as installed products.

.3 Store extra stock in location as directed later by Consultant.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.

.2 Place in appropriate on-site bins in accordance with Waste Management Plan.

.3 A weekly clean-up is mandatory and is to be undertaken the day prior to job site meeting.

.4 Failure to comply will result in clean-up and administrative costs being allocated and backcharged on a pro rated basis.

2 Products

2.1 MATERIALS

.1 Resilient Base:
- .1 PVC- Free: Supply rubber cove base 3 mm thick x 100 mm high, vulcanized rubber, in coil lengths, top set with coved toe with pre-manufactured inside and outside corners.
- .2 Base shall meet performance and dimensional requirements of ASTM F-1861, Type TS, PVC free, Group 1, Class C Fire Resistance Rating.
- .3 Colours selected by Consultant from manufacturer's full range including designer colours.
- .4 Acceptable material: Refer to Material / Finish Schedule.

.2 Surface fillers and primers:
- .1 Types and brands approved, acceptable to resilient base manufacturers for applicable conditions. Use non-shrinking latex compound.

.3 Resilient base adhesives:
- .1 Waterproof, clear setting type and brands as recommended by resilient base manufacturer.

.4 Edge Strips:
- .1 Extruded vinyl.
- .2 Colour to be selected by the Consultant.

3 Execution

3.1 EXAMINATION

.1 Examine wall surfaces to ensure that they are dry, clean, level and free from cracks, ridges a dusting, scaling and carbonation, which might preclude a satisfactory installation.
.2 Remove irregularities and fill depressions with non-shrinking latex (epoxy) compound.
.3 This Subcontractor shall check that the primer, adhesive and filler of this section are compatible. Report in writing, all errors, defects and discrepancies immediately to Consultant.
.4 Do not commence with work until unsatisfactory conditions have been corrected.
.5 Failure to report unsatisfactory conditions will be construed acceptance and approval of substrate conditions.
.6 Commencement of work shall imply acceptance of substrate with regard to conditions of substrate at time of installation.

3.2 INSTALLATION

.1 Resilient base work shall be performed by experienced and competent workers in strict accordance with manufacturers written instructions for material concerned.
.2 Fill cracks or irregularities with crack filler approved by resilient base manufacturer.
.3 Provide a solid backing over entire area behind resilient base.
.4 Apply primer in strict accordance with manufacturer's written instructions.
.5 Permit primer to dry.
.6 Apply adhesive evenly and continuously with an approved notch tooth spreader at the recommended rate for full base adhesion and contact.
.7 Mechanical spreader not approved.
.8 Do not apply adhesive in a manner which promotes induced waviness in resilient base.
.9 Do not spread more adhesive than can be covered before initial set takes place.
.10 Use waterproof adhesive throughout.
.11 Mix and spread adhesive evenly, in quantities which can be covered by resilient base within the adhesive's working time.
.12 If the adhesive over-dries, completely remove it using solvents compatible with adhesive and re-apply adhesive.
.13 Do not soil walls, bases, fitments, finish carpentry work or adjacent surfaces with adhesive.

.14 Promptly remove all excess and spillage of adhesive.
.15 Unroll coils of resilient base.
.16 Place resilient base flat to loosen coil set.
.17 Set wall base in adhesive tightly against wall and floor surfaces.
.18 Use lengths as long as practicable and not less than 500 mm long.
.19 Install resilient bases to walls, columns and fitments as indicated on the Drawings and Room Finish Schedule, during final stages of completion of work, when ceilings and permanent partitions are finished, when prime paint coats are applied and when surface conditions are suitable for installation.
.20 Set resilient base in adhesive to produce a positive, permanent bond without gaps, tight against vertical and floor surfaces for a uniform fit.
.21 Install resilient base straight and level with maximum height variation of 1:1000, having vertical, tight and flush "hairline" butt joints with no two joints closer than 610mm apart.
.22 Provide mitred internal corners.
.23 External corners shall be wrapped around corners as sharp as possible by scoring the back.
.24 Install pre-molded end stops where end of base is exposed or does not butt against a vertical surface in the finished work.
.25 Accurately scribe and fit resilient base to metal frames and other obstructions.
.26 Roll resilient base with clean, polished 2.27 kg roller, against vertical and floor surfaces to ensure full bonding to surfaces.
.27 Ensure that installation of resilient base is tight, firm, and free of bubbling and separation of any kind from surfaces.
.28 Remove defective installation as directed by Consultant and install new resilient base as specified herein.
.29 Resilient base work shall be handed over to Owner free of blemishes and in perfect condition.

3.3 CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.
.2 Clean, seal and wax floor and base surface to flooring manufacturer's instructions.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 65 13 - Resilient Base and Accessories.

1.2 REFERENCES

.1 CSA-A126.1-M1984, Vinyl Composition Floor Tile
.2 CAN/ULC-S102-2-M88, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies.
.3 CGSB 25-GP-21M-78, Floor Polish, Water Emulsion, Detergent Resistant, Non-buffable.

1.3 SAMPLES

.1 Submit samples complete with full range of available colors in accordance with Division 01 - General Requirements.

1.4 MAINTENANCE DATA

.1 Provide data for maintenance of resilient flooring for incorporation into manual specified in Division 01 - General Requirements.

1.5 MAINTENANCE MATERIAL

.1 Deliver 2% of each color, pattern and type flooring material including base required for this project for maintenance use. Identify each box. Store where directed by owner.
.2 Maintenance materials to be of same production run as installed materials.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20 C for 48 hours before, during and for 48 hours after installation.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MATERIALS

.1 Vinyl composition tile (VCT):
    .1 To CSA A-126.1 and CAN/ULC-S102.2
    .2 Type: A
    .3 Fire test data:
        .1 Flame spread: 75 or less
        .2 Smoke developed: 300 or less
    .4 Size: 305 mm x 305 mm
    .5 Thickness: 3.18 mm
    .6 Pattern: medium.
    .7 Texture: smooth
    .8 Colour: Refer to the Material / Finish Schedule.
    .9 Acceptable Materials:
        .1 Flextile "Flex-Thru" (Canada Classic).
        .2 Amtico "Fortress".

.3 Armstrong "Excelon".

.2 Stair Treads/Nosings
- .1 Rigid PVC stair nosing with 50mm wide x full tread with vinyl insert with metallic finish.
- .2 Color to be selected by Consultant
- .3 Acceptable Materials:
  - .1 Refer to the Material / Finish Schedule.

.3 Stair Tread/Landings:
- .1 Acceptable Materials:
- .2 Color to be selected by Consultant from manufacturer's standard range.
- .3 Acceptable Materials:
  - .1 Refer to the Material / Finish Schedule.

.4 Stair Landing:
- .1 Textured surface rubber floor tile 305mm x 305mm of overall thickness 3.175mm.
- .2 Color to be selected by Consultant from manufacturer's standard range.
- .3 Acceptable Materials:
  - .1 Refer to the Material / Finish Schedule.

.5 Primers and adhesives:
- .1 Primers and adhesives: as recommended by resilient flooring manufacturer for specific installation, except products with VOC's not permitted.

.6 Sub-floor filler and leveller: while premix latex requiring water only to produce cementitious paste.

.7 Edge strips:
- .1 VCT-to-concrete: vinyl reducer, Johnsonite, thickness as required.
- .2 VCT-to-porcelain tile: vinyl reducer, Johnsonite, thickness as required.

.8 Sealer: type recommended by flooring manufacturer.

.9 Wax: type recommended by flooring manufacturer.

3 Execution

3.1 INSPECTION

.1 Ensure concrete floors are dry using test methods recommended by flooring manufacturer, and exhibit negative alkalinity, carbonization or dusting.

3.2 PREPARATION OF RESILIENT TILE FLOORING

.1 Prepare concrete floors to receive resilient tile flooring in accordance with requirements of ASTM F710.

.2 Consult individual manufacturer for their specific recommendations and follow them as required.

.3 For existing floors conduct non-chemical methods of removal, such as abrasive cleaning or blast cleaning, including methods described in ASTM D4259 on existing concrete slabs with deleterious residues.

.4 Mechanically prepare concrete substrate using dustless approved method to ICRI requirements to:
- .1 CSP: Concrete Surface Profile.
- .2 Diamond Cup Ground.
- .3 Shot Blast.

.5 Remove sub-floor ridges and bumps.

.6 Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.7 Clean floor free of paint, oil, dirt or any other foreign matter detrimental to sheet flooring application.

.8 Clean floor and apply filter; trowel and float to leave smooth, flat hard surface.

.9 Prohibit traffic until filler has cured.

.10 First apply moisture reduction barrier coating on prepared concrete by rolling in crisscross direction across entire surface being treated including up to and around perimeter of any restrained surfaces such as walls and columns in accordance with manufacturer's recommendations.
.11 Clean floor and apply fast setting cement based compound filler mixed with high performance acrylic latex additive to form skim coat; fill low spots, cracks, joints, holes and other defects with sub-floor filler, trowel and float to leave smooth, flat hard surface ready for direct glue down installation of floor covering.
.12 Vacuum, prime and seal substrate to resilient tile flooring manufacturer's recommendations.

3.3 FLOORING-APPLICATION GENERAL

.1 Lay flooring in strict accordance with manufacturer's printed instructions for substrate over which material is being laid.
.2 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half width of tile.
.3 Install flooring in staggered grid pattern with continuous joints and pattern grain parallel for all units and parallel to width or room.
.4 Roll flooring to ensure full adhesion in accordance with flooring manufacturer's recommendations.
.5 Cut flooring neatly around fixed objects.
.6 Install flooring in pan type floor access covers. Maintain floor pattern.
.7 Terminate flooring at centerline of door openings where adjacent floor finish or color is dissimilar.
.8 Install metal edge strips at unprotected or exposed edges where flooring terminates and between flooring and dissimilar materials, in accordance with Par. 2.1.5 above.

3.4 CLEANING AND WAXING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.
.2 Clean, seal and wax floor surface to flooring manufacturer's instructions.

3.5 PROTECTION OF FINISHED WORK

.1 Protect new floors from after initial waxing until just before final waxing and final inspection.
.2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

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1 General

1.1 RELATED REQUIREMENTS

.1 Section 05 50 00 - Metal Fabrications.
.2 Section 06 10 53 - Miscellaneous Rough Carpentry.
.3 Section 08 11 13 - Hollow Metal Doors and Frames.
.4 Section 08 14 16 - Flush Wood Doors.
.5 Section 09 21 16 - Gypsum Board Assemblies.
.6 Mechanical Sections.
.7 Electrical Sections.

1.2 REFERENCES

.1 Department of Justice Canada (Jus)
  .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33
  .2 Environmental Protection Agency (EPA)
    .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).
  .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
    .1 Material Safety Data Sheets (MSDS).
  .4 Master Painters Institute (MPI)
    .1 MPI Architectural Painting Specifications Manual, 2004.
  .5 National Fire Code of Canada - latest edition.
  .6 Society for Protective Coatings (SSPC)
    .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

1.3 DEFINITIONS

.1 "Exposed" means visible in completed work. In case of closets, cabinets and drawers, it includes their interiors. Exposed surfaces in underground parking areas are considered "Exterior" for purpose of this Contract.
.2 "Surface Preparation" means cleaning or treating of surface to be painted to ensure best possible bond between surface to and painting to be applied; remove surface contaminants that will affect performance of painting, without limitations such as oil, grease, salts, dust, dirt, rust, rust scale, ill scale, and old coatings where applicable; remove surface imperfections without limitations such as weld spatter, sharp edges, burrs, silvers, laminations, pits, porosities and crevices; prepare surfaces to provide anchor profile or surface profile which improve mechanical bonding of coating to prepared surface by increasing surface area.

1.4 QUALITY ASSURANCE

.1 Qualifications:
  .1 Contractor: minimum of five years proven satisfactory experience.
  .2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.
  .3 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.
.2 Pre-Installation Meeting:
  .1 Attend pre-installation meeting one week prior to beginning work of this Section.
    .1 Verify project requirements.
    .2 Review installation and substrate conditions.
    .3 Coordination with other building subtrades.
    .4 Review quality expectations.
.3 Standard of Acceptance:
  .1 Walls: No defects visible from a distance of 1000 mm at 900 to surface.

.2 Soffits: No defects visible from floor at 450 to surface when viewed using final lighting source.
.3 Final coat to exhibit uniformity of color and uniformity of sheen across full surface area.

1.5 HEALTH AND SAFETY

.1 Occupational Health and Safety in accordance with Division 01 - General Requirements.

1.6 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Environment Choice Program:
.1 Provide paint products certified to meet the requirements of the Environmental Choice Program, Department of the Environment.
.2 Submit CSA Certification Reports that products proposed for use are certified under the Environmental Choice Program.

1.7 INSPECTION REQUIREMENTS

.1 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Consultant and Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.
.2 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Owner.
.3 Exterior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify the Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
.4 Exterior surfaces requiring painting shall be inspected by the Paint Inspection Agency who shall notify Consultant and Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

1.8 QUALITY CONTROL

.1 Provide mock up in accordance with Division 01 - General Requirements.
.2 Prepare and paint one (1) designated wall of one (1) room to requirements specified herein, with specified paint with selected colors, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval.
.3 On completion have paint thickness tested for proper film thickness. Do not proceed with balance of project until test results are in compliance with MPI Painting Specification Manual standards.
.4 When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on site work.

1.9 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data:
.1 Submit manufacturer's literature, data sheets for each type of material provided under this Section for Project. Data sheets shall provide all required information. Submit manufacturer's installation instructions.
.2 Material Safety Data Sheets: Submit MSDS for inclusion in Operation and Maintenance Manual without limitations for adhesives, sealants, patching and leveling compound, solid polymer and as designated later by Consultant.
.3 Progress Reports:

.1 Materials: Submit in writing list of proposed materials prepared by paint manufacturer, for approval at least 60 Days before materials are required. List shall bear manufacturer's official certification that materials listed meet or exceed requirements specified herein.

.4 Samples:
- .1 Submit for review and acceptance of each unit.
- .2 Samples will be returned for inclusion into work.
- .3 Submit 200 x 305 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.

.5 Manufacturer's Instructions:
- .1 Submit manufacturer's installation and instructions.

.6 Closeout Submittals: submit maintenance data for incorporation into manual specified in Division 01 - General Requirements. include following:
- .1 Product name, type and use.
- .2 Manufacturer's product number.
  - .1 Color numbers and associated locations.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Division 01 - General Requirements.

.2 Deliver and store materials in original containers, sealed, with labels intact.

.3 Labels shall clearly indicate:
- .1 Manufacturer's name and address.
- .2 Type of paint or coating.
- .3 Compliance with applicable standard.
- .4 Color number in accordance with established color schedule.

.4 Remove damaged, opened and rejected materials from site.

.5 Provide and maintain dry, temperature controlled, secure storage.

.6 Observe manufacturer's recommendations for storage and handling.

.7 Store materials and supplies away from heat generating devices.

.8 Store materials and equipment in a well ventilated area with temperature range 7°C to 25°C.

.9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.

.11 Remove paint materials from storage only in quantities required for same day use.

.12 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

1.11 FIRE SAFETY REQUIREMENTS

.1 Provide one - 3kg Type ABC fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.12 SITE CONDITIONS

.1 Environmental Requirements: Paint and finish in clean, dust-free, properly ventilated and adequately lit areas (minimum 100 lx (9.3 ft candles).

.2 Maintain minimum interior temperature of 18 deg C during application and drying of paint and maintain until building occupancy occurs.

.3 Do not undertake exterior painting if air and surface temperature are expected to fall below 10 deg C before coating has dried. Avoid painting during winds, weather conditions which may

affect paint application or following rain. Wait until frost, dew or condensation has evaporated. Avoid painting surfaces exposed directly to hot summer sun.

.4 Do not undertake interior painting on surfaces where condensation has or will form due to presence of high humidity and lack of proper ventilation.

.5 Ventilate enclosed spaces.

.6 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.7 Perform no painting work when maximum moisture content of substrate exceeds:

- .1 12% for concrete.
- .2 12% for clay and concrete brick and block.
- .3 15% for wood.
- .4 12% for stucco, plaster and gypsum board.

.8 Test concrete, masonry and plaster surfaces for alkalinity as required.

.9 Surface and Environmental Conditions:

- .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
- .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
- .3 Apply paint only when previous coat of paint is dry or adequately cured.
- .4 Apply paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.
- .5 Do not apply paint when:
  - .1 Temperature is expected to drop below 10°C before paint has thoroughly cured.
  - .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.
  - .3 Surface to be painted is wet, damp or frosted.
- .6 Provide and maintain cover when paint must be applied in damp or cold weather.
- .7 Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer.
- .8 Protect until paint is dry or until weather conditions are suitable.
- .9 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
- .10 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of the Consultant such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.13 EXTRA MATERIAL

.1 Submit maintenance materials in accordance with Division 01 - General Requirements.

.2 Submit one - one liter can of each type and color of primer, identified color and paint type in relation to established color schedule and finish system.

.3 Deliver and store where directed.

1.14 SCHEDULING OF THE WORK

.1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Consultant for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.15 WARRANTY

.1 Warrant work of this Section for period of two (2) years against defects and/or deficiencies in accordance with General Conditions of the Contract.

.2 Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.
.3 Defects include but are not limited to; material shrinkage, cracking, splitting and defective workmanship including but are not limited to failure in bubbling, blistering and delamination.

1.16 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.
.4 Separate for reuse and place in designated containers steel waste in accordance with Waste Management Plan.
.5 Handle and dispose of hazardous materials in accordance with CEPA, regulations.
.6 Unused paint materials must be disposed of at official hazardous material collections site.

2 Products

2.1 MATERIALS

.1 Provide paint materials for paint systems from single manufacturer.
.2 Conform to latest MPI requirements for painting work including preparation and priming.
.3 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
.4 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
.5 Provide paint products meeting MPI "Environmentally Friendly", E2 ratings based on VOC (EPA Method 24) content levels.
.6 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
.7 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.00C or greater.
.8 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
    .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
    .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
.9 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.
.10 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.
.11 Recycled water-borne surface coatings must not contain:
    .1 Lead in excess of 600.0 ppm weight/weight total solids.
    .2 Mercury in excess of 50.0 ppm weight/weight total product.
    .3 Cadmium in excess of 1.0 ppm weight/weight total product.
    .4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.
    .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

.12 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique No. 8081 as defined in EPA SW-846.

.13 Painting products: except where specifically specified otherwise all paint to be latex base with the following manufacturer's product lines as Acceptable Material for use on this project.

- .1 PPG - Pure Performance - 0 VOC.
- .2 Benjamin Moore - Genex - 0 VOC.
- .3 Glidden Lifemaster 2000 - 0 VOC.
- .4 Interior Latex:
  - .1 Benjamin Moore Ultra Spec 500.
  - .2 Sherwin Williams Promar 200 Zero VOC.
  - .3 PPG Architectural - Dulux X-Pert.
- .5 Exterior:
  - .1 Colour Your World - 5600 Series.
  - .2 CIL/Glidden - 9420 Series.
  - .3 PPG - 1 Series
- .6 Primers
  - .1 Latex or alkyd as recommended by paint manufacturer except where specifically indicated otherwise.

2.2 COLORS

.1 Consultant will provide Color Schedule after Contract award.

.2 Color schedule will be based upon selection of six (6) base colors and four (4) accent colors. Allow for two (2) deep base colors for base and accent colors.

.3 Selection of colors from manufacturers full range of colors.

.4 Second coat in three coat system to be tinted slightly lighter color than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform color tinting operations prior to delivery of paint to site in strict accordance with manufacturer's written instructions.

.2 Paste, powder or catalyzed paint mixes shall be mixed

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.

.5 Re-mix paint prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.

2.4 GLOSS / SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 Degrees	**Sheen @ 85 Degrees**
Glass Level 1	Matte finish (flat)	Max. 5 Max. 10
Gloss Level 2	Velvet-Like Finish	Max. 10 10 to 25
Gloss Level 3	Eggshell Finish	10 to 25 10 to 35
Gloss Level 4	10 to 25 10 to 35	20 to 35 min. 35
Gloss Level 5	20 to 35 min. 35	35 to 70
Gloss Level 6	Traditional Gloss	70 to 85
Gloss Level 7	High Gloss Finish	More than 85

.2 Gloss level ratings of painted surfaces as indicated.

2.5 INTERIOR PAINTING SYSTEMS

.1 Concrete vertical surfaces: including horizontal soffits:
  .1 INT 3.1C - High performance architectural latex gloss level 5-semi-gloss finish.
.2 Concrete horizontal surfaces: floors and stairs:
  .1 INT 3.2D - Pigmented polyurethane finish.
  .2 INT 3.2F - Concrete floor sealer.
  .3 INT 3.2H - Latex zone/traffic marking finish for parking lines, etc.
.3 Concrete masonry units: smooth and split face block and brick:
  .1 INT 4.2D - High performance architectural latex gloss level 5-semi-gloss finish.
.4 Structural steel and metal fabrications:
  .1 INT 5.1R - High performance architectural latex gloss level 5-semi-gloss finish.
.5 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.
  .1 INT 5.3L - Alkyd gloss level 5-semi-gloss finish (over non-cementitious primer).
.6 Dressed lumber: including doors, door and window frames, casings, mouldings:
  .1 INT 6.3A - High performance architectural latex gloss level finish.
.7 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
  .1 INT 9.2B - High performance architectural latex gloss level finish.

2.6 EXTERIOR PAINTING SYSTEMS

.1 Concrete Horizontal Surfaces: decks
  .1 EXT 3.2H - Clear waterborne sealer.
.2 Structural Steel and Metal Fabrications:
  .1 EXT 5.1F - Epoxy finish.
.3 Galvanized Metal: not chromate passivated
  .1 EXT 5.3D - Pigmented polyurethane finish for use in high contact/high traffic areas.
.4 Dimension Lumber: columns, beams, exposed joists, underside of decking, siding, fencing, etc.
  .1 EXT 6.2J - Pigmented polyurethane finish.
.5 Dressed Lumber: doors, door and window frames, casings, battens, smooth fascias, etc.
  .1 EXT 6.3C - Solid color stain finish do not use in high contact areas or on doors.
  .2 EXT 6.3D - Semi-transparent stain finish do not use on doors.
.6 Wood Paneling: plywood siding, fascias, soffits, etc.
  .1 EXT 6.4C - Solid color stain finish.
  .2 EXT 6.4D - Semi-transparent stain finish.

3 Execution

3.1 TOPCOAT AND INTERMEDIATE COAT THICKNESSES

.1 Latex & Acrylics (Interior): 0.03 mm (1.2 mils) DFT/coat.
.2 Latex & Acrylics (Exterior): 0.038 mm (1.5 mils) DFT/coat.
.3 Epoxys (Interior): 0.076 mm (3 mils) DFT/coat.
.4 Urethanes (Interior and Exterior): 0.076 mm (3 mils) DFT/coat.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.3 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual.
.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.4 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavorable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.5 PREPARATION

.1 Protection:

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.

.2 Surface Preparation:

- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 Place "WET PAINT" signs in occupied areas as painting operations progress.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

- .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalies, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.6 Apply wood filler to nail holes and cracks.

.7 Tint filler to match stains for stained woodwork.

.8 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.9 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.

3.6 APPLICATION

.1 Method of application to be as approved by Consultant.

.2 Brush and Roller Application:

- .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
- .2 Work paint into cracks, crevices and corners.
- .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
- .5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

- .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
.4 Brush out immediately all runs and sags.
.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
.7 Sand and dust between coats to remove visible defects.
.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
.9 Finish inside of cupboards and cabinets as specified for outside surfaces.
.10 Finish closets and alcoves as specified for adjoining rooms.
.11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.7 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with color and finish to match adjacent surfaces, except as indicated.
.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
.5 Do not paint over nameplates.
.6 Keep sprinkler heads free of paint.
.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matte black paint.
.8 Paint fire protection piping red.
.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
.10 Paint natural gas piping yellow.
.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
.12 Do not paint interior transformers and substation equipment.

3.8 FIELD QUALITY CONTROL

.1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Consultant and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.
.3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or

coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Consultant.

.4 Field inspection of painting operations to be carried out by independent inspection firm as designated by Consultant.

.5 Advise Consultant when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.6 Cooperate with inspection firm and provide access to areas of work.

.7 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Consultant.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed 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.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 53 - Miscellaneous Rough Carpentry
.2 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 ANSI/CABO A117.1 - American National Standard for Buildings and Facilities - Providing Accessible and Usable Buildings and Facilities.
.2 ASTM A 176 - Standard Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip.
.3 ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
.4 ASTM D 256 - Standard Test Methods for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
.5 ASTM D 543 - Standard Test Methods for Resistance of Plastics to Chemical Reagents.
.6 ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
.7 ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
.8 ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load.
.9 ASTM D 785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
.10 ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
.11 ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
.12 ASTM D 1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
.13 ASTM D 1822 - Standard Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials.
.14 ASTM D 2240 - Standard Test Method for Rubber Property--Durometer Hardness.
.15 ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
.16 ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
.17 CAN/ULC S102.2 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
.18 SAE J-1545 - Recommended Practice; Society of Automotive Engineers.
.19 UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.3 SUBMITTALS

.1 Make submittals in accordance with requirements of Division 01 - General Requirements.
.2 Product Data:
  .1 Manufacturer's complete and current Product Data for each product required, including complete installation requirements.
.3 Shop Drawings:
  .1 Show locations of each item and installation details.
  .2 Provide elevations of non-standard conditions.
.4 Selection Samples:
  .1 Color charts consisting of actual product pieces, demonstrating full range of available colors, for initial color selection.
.5 Verification Samples:
  .1 305 mm long assemblies, including one end cap, in color specified.

1.4 QUALITY ASSURANCE

.1 Provide test reports showing compliance with the performance specified including.
  .1 Fire-related properties.
  .2 Accessibility and safety properties.
  .3 Impact strength.
.2 Fire Resistance: Where fire ratings are specified for flush mounted corner guards, provide assemblies that have been tested and rated in accordance with ASTM E 119.
.3 Corner Guards - Performance Requirements:
  .1 Pull out capacity complying with State of California requirements, as administered by the Office of Statewide Health Planning and Development (OSHPD), and ANSI A117.1 requirements.

1.5 MAINTENANCE

.1 Extra Materials: Supply following quantity of maintenance material in accordance with Division 01 - General Requirements:
  .1 Quantity: 5% of the Work.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.
.2 Place in appropriate on-site bins in accordance with Waste Management Plan.
.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MANUFACTURERS

.1 The specification is based on Pro-Tek Systems Inc. Corner Guards, CG-51, with concealed fastening.
.2 Requests for equal are to be submitted in accordance with provisions of Section 00 21 13 - Instructions to Bidders.

2.2 MATERIALS

.1 Stainless Steel:
  .1 16 gauge, Type 304, #4 Satin Stainless Steel.

2.3 CORNER GUARDS

.1 Height of corner guards: 1220mm.
.2 Wing: 50mm.
.3 Locations: all outside corners of new GWB throughout building.

2.4 ACCESSORIES

.1 Fasteners: concealed mounting.
.2 Adhesive: water resistive type as recommended by manufacturer for the applicable substrate.

3 Execution

3.1 EXAMINATION

.1 Verify that walls are in proper condition to receive installation of corner guards.
.2 Surface mounted corner guards must be installed after wall finishes have been completed.

3.2 INSTALLATION

.1 Install corner guards in full compliance with manufacturer's installation instructions.

3.3 ADJUSTING AND CLEANING

.1 Verify that corner guards are plumb and rigidly secured to substrate; make any adjustments required.

.2 Clean corner guards and immediate areas of installation, using materials and methods recommended by manufacturer.

.3 Remove from project site packaging and debris caused by installation.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Provide accessories per this specification section and as per the Accessories Schedule included in the appendices.

1.2 RELATED REQUIREMENTS

.1 Section 05 50 00 - Metal Fabrications
.2 Section 06 10 53 Miscellaneous Rough Carpentry.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)
  .1 ASTM A167-99, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  .2 ASTM B456-95, Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  .3 ASTM A653/A653M-99, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  .4 ASTM A924/A924M-99, Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  .5 ASTM A666-03 - Specification for Annealed or Cold-Worked Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar.
  .6 ASTM B456-03 - Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-1.81-M90 - Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
  .2 CAN/CGSB-1.88-92 - Gloss Alkyd Enamel, Air Drying and Baking
  .3 CGSB 31-GP-107Ma - Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
  .4 CAN/CSA-G164-M92 (R2003) - Hot Dip Galvanizing of Irregularly Shaped Articles.
  .5 CSA W59-03 - Welded Steel Construction (Metal Arc Welding)
  .6 CAN/CGSB-12.5-M86, Mirrors, Silvered.
.3 Canadian Standards Association (CSA)
  .1 CSA Standards\CSA-B561-04, Barrier-Free Design.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.
.2 Product Data:
  .1 Submit manufacturer's literature, data sheets for each type of material provided under this Section.
  .2 Data sheets shall provide all required information.
  .3 Submit required copies of detailed instructions for maintaining, preserving and keeping materials in clean and safe conditions and give adequate warning of maintenance practices or materials detrimental to specified materials.
  .4 Submit manufacturer's installation instructions.
.3 Material Safety Data Sheets:
  .1 Submit MSDS for inclusion in Operation and Maintenance Manual.
.4 Shop Drawings:
  .1 Shop drawings shall be in the form of catalogue cuts and fully illustrate specified materials with description of components, surface finishes, hardware and securement devices.

.2 Submit a full schedule of accessories and identify Contractor Supplied / Contractor Installed and Owner Supplied / Contractor Installed accessories.

.5 Samples:
- .1 Submit complete samples of each accessory and modular unit to Consultant for review of construction quality, materials and finish prior to delivery of required quantities of items.
- .2 Submit sample of each colour where applicable.
- .3 No trademark and/or labels shall be accepted on exposed finishes.

.6 Maintenance Instructions:
- .1 Submit an accessories schedule, keys and parts manual as part of project closeout documents.
- .2 Submit 2 sets of following items of manufacturer's literature:
  - .1 Technical Data Sheets of each item used for the project.
  - .2 Service and Parts Manuals.
- .3 Name of local representative to be contacted in the event of need of field service of consultation.
- .4 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Division 01 - General Requirements.

.2 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Division 01 - General Requirements.

.3 Deliver special tools to Owner.

1.6 EXTRA MATERIALS

.1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Division 01 - General Requirements.

.2 Deliver special tools to Consultant.

1.7 WARRANTY

.1 Warrant work of this Section for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract.

.2 Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

.3 Defects include but are not limited to; deterioration of mirror's silvering.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate for disposal waste material generated by this Section.

.2 Place in appropriate on-site bins in accordance with Waste Management Plan.

.3 A clean worksite is mandatory at all times. Failure to maintain the site in a clean, safe condition shall result in the Owner initiating a clean-up and related costs being deducted from progress claims.

2 Products

2.1 MATERIALS

.1 Sheet steel: commercial quality to ASTM A653/A653M with ZF001 designation zinc coating.

.2 Stainless steel sheet metal type 302 or 304: to ASTM A167, with #4 finish. minimum 0.8mm thick except where noted otherwise.
.3 Stainless steel tubing type 304: commercial grade, seamless welded, 1.2 mm wall thickness.
.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fiber, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 BLOCKING

.1 Provide blocking for all accessories regardless of supply or installation responsibilities.

2.3 FINISHES

.1 Chrome and nickel plating: to ASTM B456 79 satin polished finish.
.2 Baked enamel: condition metal by applying one coat of metal conditioner to CGSB 31 GP 107M, apply one coat Type 2 primer to CGSB 1 GP 81M and bake, apply two coats Type 2 enamel to CGSB 1 GP 88M and bake to hard, durable finish. Sand between final coats. Color selected from standard range by Consultant.
.3 Manufacturer's or brand names on face of units not acceptable.

2.4 SCHEDULE OF ACCESSORIES

.1 Supply and install each item in quantities shown on Accessories Schedule.
.2 Confirm Owner Supplied / Contractor Installed or Contractor Supplied / Contractor Installed accessories prior to preparing shop drawings and ordering.

2.5 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
.3 Brake form sheet metal work with 1.5 mm radius bends.
.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
.5 Back paint components where contact is made with building finishes to prevent electrolysis.
.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.
.7 Shop assemble components and package complete with anchors and fittings.
.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
.9 Provide steel anchor plates and components for installation on studding and building framing.

3 Execution

3.1 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:
  .1 Stud walls: install wood blocking in stud space prior to plaster or drywall finish.
  .2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.
  .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
.2 Install grab bars on built-in anchors provided by bar manufacturer.
.3 Use tamper proof screws/bolts for fasteners.
.4 Fill contractor supplied units with necessary supplies shortly before final acceptance of building.
.5 Install Owner supplied washroom accessories.
.6 Install mirrors in accordance with Section 08 80 00 - Glazing.

END OF SECTION

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1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Division 01 - General Requirements.
.2 Shop drawings; submit drawings stamped and signed by Contractor as reviewed.
.3 Shop drawings to show:
  .1 Mounting arrangements.
  .2 Operating and maintenance clearances.
.4 Shop drawings and product data accompanied by:
  .1 Detailed drawings of bases, supports, and anchor bolts.
  .2 Acoustical sound power data, where applicable.
  .3 Points of operation on performance curves.
  .4 Manufacturer to certify current model production.
  .5 Certification of compliance to applicable codes.
.5 In addition to transmittal letter referred to in Division 01 - General Requirements, use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
.6 Closeout Submittals:
  .1 Provide operation and maintenance data for incorporation into manual specified in Division 01 - General Requirements.
  .2 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.
  .3 Operation data to include:
    .1 Control schematics for systems including environmental controls.
    .2 Description of systems and their controls.
    .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    .4 Operation instruction for systems and component.
    .5 Description of actions to be taken in event of equipment failure.
    .6 Valves schedule and flow diagram.
    .7 Colour coding chart.
  .4 Maintenance data to include:
    .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
    .2 Data to include schedules of tasks, frequency, tools required and task time.
  .5 Performance data to include:
    .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
    .2 Equipment performance verification test results.
    .3 Special performance data as specified.
  .6 Approvals:
    .1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for approval four (4) weeks prior to Substantial Completion. Submission of individual data will not be accepted unless directed by Consultant.
    .2 Make changes as required and re-submit as directed by Consultant.
  .7 Additional data:
    .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
  .8 Site records:
    .1 Consultant will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
.3 Use different colour waterproof ink for each service.
.4 Make available for reference purposes and inspection.

.9 As-built drawings:
.1 Prior to start of testing, finalize production of as-built drawings.
.2 Identify each drawing in lower right hand corner in letters at least 12 mm (1/2 inch) high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
.3 Submit to Consultant for approval and make corrections as directed.
.4 Perform testing, adjusting and balancing using as-built drawings.
.5 Submit completed electronic and reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Division 01 - General Requirements.
.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.3 MAINTENANCE

.1 Furnish spare parts in accordance with Division 01 - General Requirements as follows:
.1 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Division 01 - General Requirements.
.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Division 01 - General Requirements.

1.5 DEFICIENCY LIST

.1 Lists of work deficiencies will be issued at any time. Rectify immediately work to satisfaction of Consultant.
.2 Submit requests for takeover inspection in writing.

1.6 SITE SERVICES

.1 Known Services:
.1 Drawings indicate known existing facilities.
.2 Locate all known services prior to initiating work.
.3 Consult with and follow Engineer's written instructions before commencing work.
.4 Once location has been set out, assume responsibility for all damage during installation. Bear cost of repairs and replacements made necessary.

.2 Unknown Services:
.1 Locate all services whose exact location is not known.
.2 Avoid damaging or displacing existing services where exact position is not known. Should any damage occur, advise Engineer in writing for remedial instructions.

1.7 CO-ORDINATION

.1 Contractors are to note that space is limited and close coordination of the Work of all Trades is required. Before fabrication or installation begins, the Contractor must do the following:
- .1 The General Contractor is responsible for leading the interference coordination meeting. The Division 23 Ventilation Contractor is to provide an individual with sufficient experience to manage the coordination of work with all other Trades.
- .2 The Division 23 Contractor is responsible for coordinating with all other Mechanical and Electrical Trade Contractors, to minimize conflicts and poor placement of installed equipment and material; and is responsible for providing active input and coordination with all other Trades.
- .3 Extra costs associated with having to redo or relocate services due to non-participation in or non-conformance with "Interdisciplinary Coordination" process by Division 23 Ventilation Contractor, shall be by Division 23 Ventilation Contractor.
- .4 The interdisciplinary coordination process is to be collectively managed by the General Contractor and all the Mechanical and Electrical Contractors with only limited technical support by the Consultant. The Consultant's role will be limited to answering Requests for Information (RFI) and providing review of any coordination sketches prepared by the Mechanical and Electrical Contractors. Additionally the General Contractor's role will be that of providing review, overview and direction.
- .5 The Mechanical and Electrical systems are to be coordinated and work with the available space above the ceiling plane.

.2 The order of precedence in congested area's shall be:
- .1 Drainage piping;
- .2 Trunk ducts;
- .3 Sprinkler mains;
- .4 Heating mains;
- .5 Main conduits;
- .6 Water piping mains;
- .7 Branch ducts, piping and conduits.

.3 The location of equipment / outlets shall be in accordance with the Architects reflected ceiling plan. If an outlet is not shown there or is in conflict with work of another Trade, obtain direction from the Consultant before proceeding.

.4 Relocation of branch ducts, pipes or outlets within 3m of location shown on drawings to facilitate coordination with other Trades, shall not be considered extra work.

.5 Locate distribution systems, equipment and materials to provide minimum interference and maximum usable space.

.6 Where interference occurs, Consultant shall approve location of equipment and materials regardless of installation sequence.

1.8 REGULATIONS

.1 Comply with most stringent requirements of NBC, Provincial and Municipal regulations and by-laws, specified standards, codes and these specifications and plans. Practices contained in these standards or standards suggested or recommended by referenced organizations, are to be taken as minimum requirements.

.2 Furnish certificates confirming work installed conforms to requirements of authorities having jurisdiction.

1.9 DRAWINGS

.1 Drawings:
- .1 Are not intended to show structural details or architectural features.
- .2 Are not to be scaled.
- .3 Except where dimensioned, the drawings indicate general mechanical layouts only.

.2 Provide field drawings to indicate relative position of various services when required by Consultant. Obtain Consultant's approval before commencing work.

.3 As-Built (Record) Drawings:
.1 Maintain as specified in Division 01 - General Requirements.

1.10 EQUIPMENT LIST

.1 Submit list of manufacturers named within seven (7) days after award of the contract. Do not order equipment until list is approved.

1.11 ENERGY CONSUMPTION

.1 Consultant may reject equipment submitted for approval on basis of performance or energy consumed or demanded.

1.12 APPROVAL OF EQUIPMENT

.1 When equipment list has been reviewed by Consultant, conform to Division 01 - General Requirements for items shown on equipment list and all other materials and equipment necessary to complete requirements of mechanical systems. This includes equipment named under Standard of Acceptance.

1.13 BREAKDOWN OF COSTS

.1 Price will be broken down at tender time as required by depository instructions.
.2 Immediately upon notice of contract award, further break down tender price to the following minimum requirements:
.1 Sprinkler;
.2 Controls;
.3 Geothermal Wells;
.4 Plumbing;
.5 Plumbing Equipment;
.6 Geothermal;
.7 Geothermal Equipment;
.8 Ventilation;
.9 Ventilation Equipment.

1.14 APPROVED EQUALS

.1 Submission for an Approved Equal is to contain literature and descriptive information with full specification data. Where the requested item is contained on a printed document with other items, it is to be clearly identified.
.2 The Consultant will not search catalogs, e-mails or websites or contact suppliers to obtain the necessary information for proper evaluation.
.3 Submission by Bidders for evaluation of products requested to be considered as equal must be submitted to Consultant no less than 5 working days prior to closing of tenders. No consideration will be given to approving equals after the close of tenders, except when the specified product is found to have been discontinued by the manufacturer.
.4 The consideration of a product(s) for Approved Equal status and the acceptance of individual products as approved equals is entirely at the discretion of the Consultant.
.5 When products are given Approved Equal status these products may, at the discretion of bidders, be carried in their tender price, provided that ALL costs related to changes to the contract work required to incorporate the Approved Equal product are included in the tender price.
.6 The acceptance of a product by the Consultant as an "Approved Equal," even where not specifically indicated on the Approved Equals listing in the Addendum, is to be understood as being contingent upon the provision of the particular series, model and/or type, complete with all options to meet the specified requirements of the Acceptable Material product.
.7 Products given approved status that are found, during construction period, to not have all specified options available, or do not fit in the available space, or to have discontinued production of same, or to have made other design changes since the time of approval, will not

be accepted for use on this project, except when financial compensation has been mutually agreed upon between the Contractor and the Owner and deemed acceptable by the Consultant. Compensation will not be paid to the Contractor for products acknowledged by the Consultant to be superior to the specified products.

.8 The Contractor is cautioned that all layouts on the Mechanical drawings are based on the specified equipment. Any changes necessary, using acceptable materials will be done at the Contractor's expense. Furthermore, if it is found that the provisions made regarding space conditions are not met, the right is reserved by the Consultant to require installation of the equipment used on the layout.

1.15 PACKAGED EQUIPMENT

.1 The Contractor shall note that whenever package equipment is specified, it is intended that this equipment shall be a complete package with all necessary accessories to allow for fail safe automatic operation.

.2 These accessories shall include all necessary starters, disconnects, relays, transformers, pressure switches, sensors, timers, etc. Where subject to the weather, the device shall be enclosed in a "weatherproof" enclosure.

.3 The Contractor shall be responsible for checking with the supplier of the equipment to ensure that the package equipment is complete with all necessary accessories. The Contractor shall also determine which accessories are factory mounted and which ones are shipped loose with the equipment. The Contractor shall include in his tender an amount for all necessary wiring and piping etc., required to incorporate loose pieces of equipment into the job at no additional cost to the Owner.

.4 The Contractor shall note that the above refers to all package equipment, including but not limited to, geothermal water-to-air heat pumps, energy recovery ventilators, and pumps. It shall be his responsibility to ensure the supply and installation of any accessories necessary for the operation of this equipment.

1.16 AS INDICATED

.1 Means that the item or items specified are shown or noted on the drawings.

1.17 EQUIPMENT REQUIREMENTS & INSTALLATION

.1 Permit equipment maintenance and disassembly by use of unions or flanges to minimize disturbance to connecting piping without interference from building structure or other equipment.

.2 Space for servicing, disassembly and removal of equipment and components to be provided as recommended by Manufacturer or as indicated.

.3 Equipment drains to be piped to hub or funnel floor drain.

.4 Provide ready access to lubrication points for equipment requiring periodic lubrication, in accordance with the manufacturer’s instructions.

.5 Mount base mounted equipment on chamfered edge housekeeping pads a minimum of 100mm (4") high and 50mm (2") larger than equipment dimension all around. Pads provided by this Contractor. Co-ordinate sizes with equipment provider.

.6 Pipe drain lines to drains in a manner to avoid disruption of surrounding space.

.7 Line-up equipment, rectangular cleanouts and similar items parallel or perpendicular to building walls wherever possible.

.8 Contractor to provide metal caps and counter flashing for all roof penetrations provided under this section. Installation by this Contractor. This Contractor responsible for all membrane flashing.

1.18 RESPONSIBILITY FOR TEMPORARY TRIAL USAGE

.1 Protect work against damage or loss until accepted by the Consultant.

.2 Obtain written permission to start and test permanent equipment and systems prior to acceptance by Consultant.

.3 Consultant may use equipment and systems for test purposes prior to acceptance. Supply labour, material and instruments required for testing.
.4 See Division 01 - General Requirements for temporary usage. Guarantee period and commencement date shall not be affected.
.5 Clean and renew equipment and system used prior to acceptance. Restore to original, new and full working condition.

1.19 ANCHOR BOLTS & TEMPLATES

.1 Supplied and installed by Division 21, 22, 23 and 25, as indicated and recommended by the Manufacturer.

1.20 PROTECTION OF OPENINGS

.1 Protect equipment, system openings including rough-in plumbing from dirt, dust and other foreign materials with materials compatible to the system.

1.21 GUARDS

.1 Provide guards for unprotected drives.
.2 Guards for belt drives:
  .1 Expanded metal screen welded to steel frame.
  .2 Minimum 1.2mm thick sheet metal top and bottoms.
  .3 38mm diameter holes on both shaft centers for insertion of tachometer.
  .4 Removable for servicing.
.3 Provide means to permit lubrication and use of test instruments with guards in place.
.4 Install belt guards to allow movement of motors for adjusting belt tension.
.5 Guard for flexible coupling:
  .1 "U" shaped, minimum 1.6mm thick galvanized mild steel.
  .2 Securely fastened in place.
  .3 Removable for servicing.
.6 Unprotected fan inlets or outlets.
  .1 Wire or expanded metal screen, galvanized 19mm mesh.
  .2 Net free are of guard: not less than 80% of fan openings.
  .3 Securely fasten in place.
  .4 Removable for servicing.

1.22 SLEEVES

.1 Provide pipe sleeves at points where pipes pass through masonry or concrete walls or floors.
.2 The Division 21, 22, 23 & 25 Contractor(s) is financially responsible for all core drilling and sleeves required for their works to pass through floor slabs, foundations and block walls. Coordinate all works with General Contractor and all other Divisions. All core drilling to be performed by a qualified Contractor.
.3 Provide acoustical pipe penetration seals where pipes pass through equipment room walls or floors.
  .1 Seals to consist of two bolted pipe halves with minimum 19mm neoprene sponge bonded to inner face.
  .2 Seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping.
  .3 Use cast iron or steel pipe sleeves with annular fin continuously welded at midpoint:
    .1 Through foundation walls.
    .2 Where sleeve extends above finished floor.
  .4 Sizes:
    .1 Provide 6mm (1/4") clearance all around, between sleeve and pipes or between sleeve and insulation.

.2 Where piping passes below footings, provide minimum clearance of 50mm (2") between sleeve and pipe. Backfill up to underside of footing with concrete of same strength as footing.

.5 Terminate sleeves flush with surface of concrete and masonry and 50mm above floors in mechanical or fan rooms or rooms susceptible to leaks. Not applicable to concrete floors on grade.

.6 Unless otherwise indicated for pipes passing through roofs, use Thaler Industries model MEF-34 or MEF-44 aluminum mechanical flashings, height 300mm (12"). Anchor flashings in roof construction. Install in accordance with manufacturer's instructions. Make water tight durable joint.

.7 Fill voids around pipes. Remove plastic sleeves.

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof pre-retardant non-hardening mastic or manufactured seals equal to "link-seal".

.2 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe and sleeve with waterproof fire retardant non-hardening mastic. Seal space at each end of sleeve with non-shrinking pipe sealing mastic.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future-use sleeves with lime plaster.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M.

.6 Installation to be continuous through walls and floors.

.8 Temporarily plug all openings during construction.

1.23 ESCUTCHEONS AND PLATES

.1 Provide on pipes and ductwork passing through finished walls, partitions, floors and ceilings.

.2 Use chrome or nickel plated brass, solid type, with set screws for ceiling or wall mounting. Use cast iron type in equipment room. Where split escutcheons are used, they shall be installed to provide continuous appearance.

.3 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.

.4 Where sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.

.5 Secure to pipe or finished surface but not insulation.

1.24 TESTS

.1 Provide the following supplementary requirements to tests specified:

.1 Give written 24 hours notice of date when tests will be made.

.2 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.3 Conduct tests in presence of Engineer.

.4 Bear costs including retesting and making good.

.5 Pipe pressure:

.1 Hydraulically test all water supply and steam supply systems at 1 1/2 times system operating pressure or minimum 860 kPa.

.2 Maintain test pressures without loss for 4 hours unless otherwise specified.

.3 Test drainage, waste and vent piping to code.

.4 Prior to test isolate all equipment or other parts which are incomplete or not designed to withstand test pressures.

.5 All piping of the drainage and venting systems shall be tested by means of filling the system with water after all outlets have been plugged. All joints shall be checked and the water level must hold without dropping for a period of one hour before the work is to be backfilled or otherwise built-in. Sections of the system may be tested separately provided they are at least 3000mm

(120") high and include at least 1500mm (60") of the section below, where applicable. Any leaks observed must be corrected by additional caulking of joints or if necessary by removal of any section of pipe required.

.6 Testing shall be done before pipe covering is installed. Leaks must be located, corrected and test reapplied before acceptance of building.

.7 Provide test certification for all tests signed by Engineer or designated representative.

1.25 PAINTING

.1 Apply at least one (1) coat of corrosion resistant primer and two (2) coats of suitable industrial corrosion resistant paint to un-insulated piping, hangers, stands, supports, and equipment fabricated from ferrous metals.

.2 Prime and touch up marred finished paintwork to match original.

1.26 ACCESS DOORS

.1 This section to supply access doors for furred ceilings or spaces for servicing equipment and accessories or for inspection of safety, operating or fire devices for installation under section erecting the walls or ceilings. Provide ULC rated doors in fire rated construction. Installation by General Contractor.

.2 Access doors shall be flush mounted with integral drywall bead, sized 600 x 600 mm (24" x 24") for body entry 300 x 300 mm (12" x 12") for hand entry, or as noted on the drawings. Doors shall open 180 degrees have rounded safety corners, concealed hinges, screwdriver latches and anchor straps. Steel shall be prime coated. Doors shall be of approved manufacturer with published literature.

.3 Provide cam type locking device with hand or key lock when located in public corridors and washrooms complete with master keys.

.4 Acceptable material: Williams #WB-DW, Acudor #DW-5040, MIFAB #MDW.

1.27 DRAIN VALVES

.1 Minimum NPS 19mm (3/4") unless otherwise specified: straight pattern bronze with hose end male thread and complete with cap and chain.

.2 Locate at all low points and section isolating valves unless otherwise specified.

.3 Acceptable material: Dahl.

1.28 INSTRUCTION OF OPERATING STAFF

.1 Provide certified personnel to instruct operating staff on operation of mechanical equipment. Provide maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

.2 Provide instruction during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

.3 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn one manual over to Owner and the balance to Engineer.

.4 This Contractor to ensure mechanical systems are complete and fully operational as per the requirements of these documents and the applicable codes. Premature failure of any mechanical system(s) and/or related accessories deemed to be the result of poor workmanship shall be the financial responsibility of the Contractor responsible.

1.29 CLEANING AND FINAL ADJUSTMENT

.1 Clean interior and exterior of all systems including strainers.

.2 Clean and refurbish all equipment and leave in first class operating condition including replacement of all filters in all piping systems.

.3 Balance and adjust all systems and each piece of equipment to operate efficiently.

1.30 EXCAVATION, TRENCHING AND BACKFILLING

.1 All excavation, trenching, granular base or bedding and backfilling, both inside and outside the building, required for the work of Division 22 shall be the financial responsibility of, and carried out by the General Contractor under the direction of the Division 21, 22, 23 or 26 Sub-contractor.
  .1 This work includes the breaking out of existing concrete where new lines are installed below existing concrete floors.
  .2 This work includes housekeeping pads and concrete curbs.

1.31 CUTTING & PATCHING

.1 All cutting and patching required to properly accommodate the work of this Division shall be the financial responsibility of respective Division 21, 22 or 23 and carried out by trades to the applicable Specifications provided in this document.

1.32 FIRESTOPPING AND SMOKE SEALS

.1 All firestopping and smoke seals required to properly accommodate the work of this Division shall be the financial responsibility of the respective Division 21, 22 or 23 and carried out by trades to the applicable Specifications provided in this document.
.2 Work must be performed by a company with experience in the application of firestopping and smoke seals to ULC requirements.
.3 Material shall provide a fire rate equal to that of the separation which has been separated.
.4 Refer to the Architectural drawings for the location and rating of all fire walls.
.5 Submit material shop drawings and all ULC listed installation details for all penetrations applicable to project.
.6 Acceptable material:
  .1 Dow Corning Fire Stop System.
  .2 3M Fire Barrier Penetration.
  .3 Sealing System.
  .4 Bio-Fire Biotherm or Bio-K10 (supplied by Wormald).
  .5 Hilti.

1.33 CONCRETE

.1 All concrete work, both inside and outside the building, required specifically for the work of this Division shall be the financial responsibility of and carried out by the General Contractor under the direction of the Division 21, 22, 23 or 25 Sub-Contractor(s).
  .1 This work includes all housekeeping pads and concrete curbs.

1.34 WASTE MANAGEMENT AND DISPOSAL

.1 Collect and separate waste material and place in on site bin in accordance with Waste Management Plan.

2 Products

2.1 NOT APPLICABLE

.1 Not applicable.

3 Execution

3.1 REPAIRS/ RESTORATION

.1 To Section 09 91 00 - Painting.
.2 Prime and touch up marred finished paintwork to match original.
.3 Restore to new condition, finishes which have been damaged extensively for priming and touch-up.

3.2 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Division 01 - General Requirements and submit report as described in PART 1 - SUBMITTALS.
  .1 Pressure test.

.2 Manufacturer's Field Services:
  .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  .2 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Where specified elsewhere in Division 21, 22, 23 or 25 manufacturers to provide demonstrations and instructions.

.4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

3.5 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 Conform to the following except where specified elsewhere:
- .1 National Building Code of Canada.
- .2 NFPA 13 - Installation of Sprinkler Systems.
- .3 NFPA 25 - Inspection, Testing and Maintenance of Water Based Fire Protection Systems.
- .4 NFPA 14 - Installation of Standpipe and Hose Systems.
- .5 Section 21 05 01 - Common Work Results - Mechanical.

1.2 SHOP DRAWINGS

.1 Submit sprinkler working drawings, product data, and supporting design calculations in accordance with Division 01. Submit drawings in PDF format and final record drawings in PDF and editable DWG format. Show existing piping serving the alterations, connection points, new and relocated sprinklers, pipe sizes, elevations, supports, obstructions, sprinkler characteristics, and applicable design criteria.

.2 Shop drawings to be submitted for preliminary review prior to submitting to approving authorities.

.3 Shop drawings shall be stamped and signed by a professional engineer registered and licensed in the Province of Prince Edward Island.

1.3 GENERAL REQUIREMENTS

.1 Work covered by this Section to include renovation of the existing wet sprinkler system, all materials, labour, equipment, working plans, field testing for building and services necessary for or incidental to the design, supply, installation and completion of wet pipe automatic sprinkler system in all renovation areas noted. Work to be coordinated with construction schedule. All bidders are responsible for determining exact site requirements and the extent of work required to maintain fire protection in accordance with NFPA 13.

.2 Quality Assurances: Execute work of this Section by skilled tradesmen only, employed by qualified Fire Protection Contractor in the province regularly engaged in the installation of automatic sprinkler systems and other fire protection equipment.

.3 Systems to include:
- .1 Modifications and additions to the existing wet system as required to suit the revised floor plans and construction to meet the requirements of NFPA 13.
- .2 Auxiliary drain connections as required.
- .3 Sprinkler types as noted.

1.4 ENGINEERING DESIGN CRITERIA

.1 Design modifications to the existing automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, including hydraulic calculations for uniform distribution of water over design area, where required by the Authorities Having Jurisdiction. Occupancy hazard shall be as required by NFPA 13.

.2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Location of Sprinkler Heads:

.1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13.
.2 Uniformly space sprinklers on branch.

.7 Water Distribution:
.1 Make distribution uniform throughout the area in which sprinkler heads will open.
.2 Discharge from individual heads in hydraulically most remote area to be 100% of specified density required in NFPA 13.

.8 Density of Application of Water:
.1 Size pipe to provide specified density when system is discharging specified total maximum required flow.
.2 Application to horizontal surfaces below sprinklers shall be as required for NFPA 13.

.9 Sprinkler Discharge Area:
.1 Area: hydraulically most remote area as defined in NFPA 13.

.10 Outside Hose Allowances:
.1 Include allowance in hydraulic calculations of outside hose streams per NFPA.

.11 Friction Losses:
.1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

.12 Water Supply:
.1 Use existing sprinkler information available on site to determine basis of design in accordance with NFPA 13.

.13 Show the following in the drawings submitted to the Owner's Representative for approval.
.1 Show the existing supply arrangement and piping serving the alterations, including the riser and relevant control valves, together with connection points and all new or modified piping. Identify existing information used for the design. Determine pipe sizes by the applicable NFPA 13 design method.

1.5 OPERATIONS

.1 For Systems: indicate on building central fire alarm system panel.

1.6 CERTIFICATES

.1 Provide written certificate that components are compatible, and where applicable, certified for intended use in accordance with requirements of approving authorities.

1.7 MAINTENANCE DATA

.1 Provide maintenance data in English and French for sprinkler equipment for incorporation into operation and maintenance manual specified in Division 01 - General Requirements.

1.8 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Division 01 - General Requirements.
.2 Provide spare sprinklers in accordance with NFPA 13 latest edition and these specifications.

2 Products

2.1 PIPE AND FITTINGS

.1 Steel pipe: Schedule 40 black steel conforming to ASTM A795/A795M or ASTM A53/A53M, suitable for wet pipe sprinkler service. Provide threaded or grooved joints in accordance with NFPA 13. Prepare grooves to suit the listed coupling system and install in accordance with the manufacturer’s instructions.

.2 Fittings: 1206 kPa (175 psi) minimum working pressure, to conform to the following:
.1 Cast Iron: screwed to ASME B16.4, flanged to ASME B16.1, Class 125 and 250.
.2 Malleable Iron: screwed to ASME B16.3, Class 150 and 300.

.3 Grooved fittings and couplings: listed or certified for wet pipe sprinkler service, with working pressure ratings suitable for the system. Provide compatible housings, fittings, gaskets, bolts, nuts, and lubricant in accordance with the coupling manufacturer's listed assembly and installation instructions. Provide factory protective coatings.

.3 Reducers: One piece fittings, hex face bushings acceptable only where one piece standard reducing fittings of required size are not available.

2.2 VALVES

.1 Valves shall be ULC listed and FM approved, designed for 1205 kPa (175 psi) minimum working pressure (water) and of one manufacturer wherever possible throughout this section.
- .1 Rising stems, to be repackable under pressure and with malleable iron wheel handles.
- .2 Sprinkler valves where required and indicated on drawings, to be equipped with contacts and devices necessary for operation of supervisory system specified under Division 16.

.2 Gate Valves:
- .1 NPS 2 (DN 50) and under: Screwed bronze body and trim to ASTM B61 solid wedge, rising stem. Ball valves are acceptable as alternate.
- .2 NPS 2 (DN 50) and over: Iron body, bronze mounted, OS&Y solid wedge, flanged or roll grooved ends or butterfly gear operated (up to NPS 6 / DN 150).

.3 Globe Valves:
- .1 NPS 2 (DN 50) and under: Bronze body and trim to ASTM B61 (screwed), replaceable composition disc. Ball valves are acceptable as alternate.

.4 Drain Valves:
- .1 Angle or globe for 1206 kPa (175 psi) cold water or 362 kPa (52.5 psi) saturated steam.

2.3 SUPERVISORY AND ALARM SWITCHES

.1 Supervisory Switches:
- .1 ULC listed and FM approved, cast aluminum housing with red enamel finish, tamper proof.
- .2 Cord type plug in supervisory devices are not acceptable.

.2 Alarm Switches:
- .1 ULC listed and FM approved, cast aluminum housing with red enamel finish, tamper proof.

2.4 PIPE HANGERS

.1 Pipe hangers to be in accordance with NFPA 13 and Section 21 05 01.

2.5 SPRINKLER HEADS

.1 Provide new sprinklers ULC listed and FM Approved for use in Canada and suitable for wet pipe sprinkler service, in accordance with NFPA 13.

.2 Provide quick response glass bulb sprinklers suitable for the hazard classification. Coordinate response characteristics with retained sprinklers within the same compartment in accordance with NFPA 13.

.3 Sprinkler orientation, recessed or concealed arrangement, coverage characteristics, and K-factor shall conform to the approved sprinkler design and the requirements indicated on the drawings.

.4 Select temperature ratings in accordance with NFPA 13, the sprinkler listing, and anticipated ambient temperatures, including proximity to heat sources.

.5 Provide guards where indicated or where sprinklers are subject to mechanical damage. Guards shall be listed for use with the specific sprinkler model.

.6 Install sprinklers and accessories in accordance with their listings and the manufacturer's instructions. Do not reuse removed sprinklers or field paint sprinklers, escutcheons, or cover plates.

2.6 SLEEVES AND ESCUTCHEON PLATES

.1 Provide sleeves and escutcheon plates for sprinkler piping systems.

2.7 FINISHES

.1 Provide sprinkler finishes and listed sprinkler escutcheons or cover plates to match the approved architectural finish schedule. Provide factory finishes on valves and fittings.

.2 All piping, fittings, etc. in areas where there is no suspended ceiling to be painted by Division 09.

3 Execution

3.1 INSPECTION

.1 Piping, accessories, etc., not to be recessed, painted, or concealed before it has been inspected and approved.

3.2 INSTALLATION

.1 Install horizontal valves with stems in vertical upright position where spaces allow.

.2 Provide additional pipe hangers to allow for expansion and contraction in sprinkler system.

.3 In areas with suspended ceilings, allow ample clearance between sprinkler piping in ceiling spaces and top of light fixtures for relocation of fixtures under future renovations.

.4 Where applicable, sprinkler heads installed in suspended tile ceilings to be centered in tiles where possible, or a minimum of 150mm (6") from any edge of tile. This section shall be responsible for coordinating the location and layout of the sprinkler system and sprinkler heads with Division 26 and other related sections of Divisions 22, 23 or 25.

.5 Provide chromeplated valves, nozzles, fittings, except in unfinished areas where satin brass finish is acceptable.

.6 Exposed piping passing through floors, ceilings and walls shall be supplied with chromeplated escutcheon plates, unless otherwise approved by Consultant.

.7 Coordinate locations of all holes required for pipes and otherwise meet specified requirements of Section 21 05 01 Common Work Results - Mechanical.

.8 Allow for extra sprinkler heads in Mechanical Rooms, for air handling equipment and large ducts, and in areas where large ducts may be located exposed under ceilings, to maintain adequate coverage.

.9 All pendent sprinklers shall be installed on return bends

3.3 PROTECTION OF COMPLETED WORK

.1 Paint exposed steel pipe and fittings, except special finishes.

.2 Provide red plastic coated wire baskets around sprinkler heads in mechanical, electrical, storage, elevator machine and telephone rooms, around ventilation equipment, under stair landings, in service areas, and other areas that may be requested by authorities having jurisdiction, to protect against possible mechanical injury.

3.4 TESTING

.1 Systems and equipment to be subjected to operational test.

.2 Sprinkler Systems:

.1 Test and certify in accordance with NFPA 25. Test is to be witnessed by representatives of authorities having jurisdiction.

.2 All inspections, examinations, and tests required shall be arranged and paid for by this Section. Deliver Inspection Certificates to the Consultant. Finally, adjust equipment for operation to the satisfaction of approving authorities and Consultant.

.3 Submit all test certificates, reports and letters of approval from authorities at least 14 days prior to requesting certificate of substantial completion.

.3 Testing to be witnessed by Commissioning Agent.

3.5 SYSTEM(S) FLUSHING

.1 Where applicable ensure that sprinkler system and pressure tanks have been flushed thoroughly before making final connections and putting system into operation.

END OF SECTION

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1 General

1.1 REFERENCES

.1 NFPA 10, Portable Fire Extinguishers - 2018 Edition.
.2 CAN/ULC-S508-2018, Rating and Fire Testing of Fire Extinguishers.

1.2 SHOP DRAWINGS

.1 Submit shop drawings according to Division 01 - General Requirements.

2 Products

2.1 EXTINGUISHER

.1 FE-1: 10 lb. Type ABC dry chemical (ammonium phosphate powder) extinguisher with heavy duty mounting bracket.
    .1 Acceptable material: Extinguisher
        .1 Flag ABC -10G min. ULC rating 4-A, 60-B,C (Light & Ordinary hazard)
        .2 Flag ABC -10H min. ULC rating 6-A, 80-B,C (Extra hazard)
.2 FE-2: 10 lb. (4.5 kg) Type ABC dry chemical (ammonium phosphate powder) extinguisher with semi recessed prime coated 16 ga. steel cabinet.
    .1 Acceptable material: Extinguisher
        .1 Flag ABC -10G min. ULC rating 4-A, 60-B,C (Light & ordinary hazard)
        .2 Flag ABC -10H min. ULC rating 6-A, 80-B,C (Extra hazard)
    .2 Acceptable material: Cabinet
        .1 C.F.H. Industries Model CE-950-1
        .2 Wilson Cousins Model 1E-10C

3 Execution

3.1 INSTALLATION

.1 Install extinguishers securely mounted to walls in locations indicated on drawings.
.2 Fire extinguishers to be installed so that maximum travel distance does not exceed 22 m (72 feet).
.3 Fire extinguishers to be installed 900mm (36") above finished floor.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Complete per Section 20 05 01 all general mechanical requirements including Submittals, Coordination, Identifications, Disinfection, Testing, Fire Stopping, Access Provision, Painting, and Documentation shall apply to this Division.

.2 Section 20 05 01 General Mechanical Requirements

1.2 SUBMITTALS

.1 Submittals: in accordance with Division 01 - General Requirements.

.2 Shop drawings; submit drawings stamped and signed by a Contractor as reviewed.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.5 In addition to transmittal letter referred to in Division 01 - General Requirements, use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.6 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Division 01 - General Requirements.
- .2 Operation and maintenance manual approved by, and final copies deposited with, consultant before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .4 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .6 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Owner's Representative for approval four (4) weeks prior to Substantial Completion. Submission of individual data will not be accepted unless directed by Consultant.
  - .2 Make changes as required and re-submit as directed by Consultant.

.7 Additional data:
  .1 becomes apparent during specified demonstrations and instructions.
.8 Site records:
  .1 Consultant will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  .3 Use different colour water proof ink for each service.
  .4 Make available for reference purposes and inspection.
.9 As-built drawings:
  .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  .3 Submit to Owner's Representative for approval and make corrections as directed.
  .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
.10 Submit copies of as-built drawings for inclusion in final O & M Report.
.11 Where existing plumbing systems are to be reused or reconnected, provide detailed procedures for disinfection in accordances with owners representative, CSA 2317.1, NPCC and as listed in Section 23 08 01 Performance Verification Mechanical Piping Systems and Section 23 05 01 Installation of Pipework

1.3 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Division 01 - General Requirements.
.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health, Safety and Emergency Response Procedures.
.3 Label all new piping and equipment according to Section 23 05 54 Mechanical Identification

1.4 MAINTENANCE

.1 Furnish spare parts in accordance with Division 01 - General Requirements as follows:
  .1 One set of packing for each pump.
  .2 One casing joint gasket for each size pump.
.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Division 01 - General Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:
  .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 - General Requirements.

2 Products

2.1 MATERIALS

.1 All materials used on this project shall be new and CSA approved unless noted otherwise.

3 Execution

3.1 PAINTING, REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 00 - Painting.
.2 Prime and touch up marred finished paintwork to match original.
.3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 Clean interior and exterior of all systems including pipe, fittings, fixtures and strainers to remove construction debris, flux, scale and foreign materials prior to testing and commissioning.
.2 Flush domestic piping per 23 05 01.
.3 Clean fixture trim, escutcheons, exposed pipe surfaces, stainless steel fixtures to a uniform like new condition prior to final handover.
.4 Remove temporary caps, labels, tags and protective wrappings after final flushing and testing are complete.
.5 Remove all surplus materials, tools and debris related to plumbing installation from site and dispose of in accordance with waste management plan.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Division 01 - General Requirements and submit report as described in PART 1 - SUBMITTALS.
  .1 Perform tests as specified in other sections of this specification.
.2 Manufacturer's Field Services:
  .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  .2 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

.1 Owner's Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.
.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
.4 Instruction duration time requirements as specified in appropriate sections.
.5 Owner's Representative may record these demonstrations on video tape for future reference.

3.5 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system

END OF SECTION

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1 General

1.1 SECTION INCLUDES

.1 Materials and installation for domestic water service and Distribution Systems:
- .1 Copper Type K, Type L hard drawn.
- .2 Chlorinated PolyVinyl Chloride (CPVC) piping and fittings.
- .3 Cross linked polyethylyne (PEX) tubing and fittings.
- .4 PolyVinyl Chloride (PVC) pressure piping (cold water only)
- .5 Stainless steel piping welded or grooved.

1.2 RELATED SECTIONS

.1 Section 20 02 01 - Common Work Results - Mechanical
.2 Section 22 05 01 - Common Work Results - Plumbing.
.3 Section 23 05 01 - Installation of Pipework.
.4 Section 23 05 22 - Valves - Bronze.
.5 Section 23 05 23 - Valves - Cast Iron.
.6 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
.7 Section 23 20 21 - Thermal Insulation for Piping.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
- .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 American Society for Testing and Materials International, (ASTM).
- .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM A536 Standard Specification for Ductile Iron Castings.
- .3 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).
- .4 ASTM F2389, Standard Specification for Pressure-Rated Polypropylene (PP) Piping Systems / Testing Equipment.
- .5 ASTM D2846, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
- .6 ASTM F438, Standard Specification for Socket - Type Chlorinated Polyvinyl Chloride (CPVC) Plastics.
- .7 ASTM A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
- .8 ASTM A403, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
- .9 ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
- .10 ASTM D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- .11 ASTM F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
- .12 ASTM A999/A999M, Standard Specification for General Requirements for Alloy and Stainless Steel Pipe.
- .13 ASTM B88, Standard Specification for Seamless Copper Water Tube.
- .14 ASTM - Standard Specification for cross linked Polyethylene (PEX) tubing.

.15 ASTM F877 Standard specification for cross-linked polyethylene (PEX) plastic hot and cold water distribution systems.
.16 ASTM F 1960 Standard Specification for cold expansion fittings with PEX reinforcing rings for use with cross-linked polyethylene (PEX) tubing.

.3 American Water Works Association (AWWA).
.1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
.2 AWWA C606 Grooved and Shouldered Joints.

.4 Canadian Standards Association (CSA International).
.1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
.2 CSA B137.5 Cross-linked polyethylene (PEX) tubing systems for pressure applications.

.5 Department of Justice Canada (Jus).
.1 Canadian Environmental Protection Act, (CEPA).

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Safety Data Sheets (SDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
.1 MSS-SP-67, Butterfly Valves.
.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)/Institute for Research in Construction.
.1 NRCC 38728, National Plumbing Code of Canada (NPC).

.9 American National Standards Institute/National Sanitation Foundation (ANSI/NSF).
.1 ANSI/NSF 61 Drinking Water System Components.
.2 ANSI/NSF 14 Plastic Piping System Components and Related Materials.

1.4 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.

.2 Submit product data for following: piping, fittings, valves and adhesives.
.1 Provide manufacturers printed product literature and data sheets including product characteristics, performance criteria, physical size, finish and pressure/temperature limitations.
.2 Certifications for pressure rating, NSF 61 and CSA compliance.

.3 Submit WHMIS SDS - Safety Data Sheets to Consultant for each hazardous material prior to bringing hazardous materials to site.

.4 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements

.5 Grooved joint couplings and fittings to be indicated on product submittals and to be specifically identified with the applicable style or series designation.

.6 Cross linked polyethylene (PEX) tubing.
.1 Submit manufacturer’s product data, sizing information, and installation requirements for the proposed PEX tubing and fitting system. Where PEX is used in place of copper piping indicated on the Contract Drawings, verify tubing sizes using the selected manufacturer’s published flow-capacity, pressure-loss, and velocity data. Do not substitute PEX for copper on a nominal size-for-size basis unless supported by the manufacturer’s sizing data. Identify proposed PEX tubing sizes that differ from the copper pipe sizes indicated.
.2 Submit revised layout drawings, riser diagrams, and fixture-group or manifold details where PEX routing differs from the Contract Drawings or where manifolds are proposed. Indicate tubing sizes, fixture-unit loads, design flow rates, available pressure at the most remote fixture served by PEX, balancing requirements, and transitions between copper and PEX.
.3 Submit manufacturer’s requirements for fittings, bend radii, hanger spacing, continuous support channels, riser supports, anchors, guides, thermal expansion and

contraction, sleeves, penetrations, and transition fittings. Provide all resizing, fittings, supports, and accessories required for the selected PEX system.

.7 PVC / CPVC:
- .1 Submit pipe sizing calculations showing pressure drop. Expansion allowance and thermal compensation / expansion.
- .2 Submit solvent-cement joining procedures, installer training records, tool requirements, compatible primer and cement data, cure-time requirements, and pressure-testing limitations.

1.5 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Division 01 - General Requirements

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse in accordance withDivision 01 - General Requirements.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Separate for reuse and recycling and place in designated containers Steel waste in accordance with Waste Management Plan.
.4 Place materials defined as hazardous or toxic in designated containers.
.5 Handle and dispose of hazardous materials in accordance with CEPA and local or municipal regulations.
.6 Fold up metal banding, flatten and place in designated area for recycling.

1.7 QUALITY ASSURANCE

.1 All pipe, fittings, valves, joining materials, gaskets, coatings, and wetted components in contact with potable water shall be certified for potable-water use and meet the requirements of NSF/ANSI/CAN 61 and NSF/ANSI/CAN 372 where applicable.

.2 Cross Linked Polyethylene (PEX) tubing
- .1 Qualifications:
  - .1 Installer Qualifications: Installer shall be experience in performing work of this section and has specialized in installation of work similar to that required for this project.
  - .2 Installer Qualifications: Installer shall be recognized by the tubing/fitting manufacturer as a "Trained Installer".
  - .3 Installation Qualifications: Installation must be by skilled tradesperson holding trade qualification license or apprentices under the supervision of a licensed tradesman.
- .2 Regulatory Requirements: PEX tubing and components shall be installed in full compliance with all Federal, Provincial and Municipal codes, standards and requirements.
- .3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

.3 Press Joint Copper Systems.
- .1 Installer shall be a qualified, licensed within the jurisdiction, and factory trained with the installation of copper press joint systems. Certificate of factory training shall be submitted prior to starting work.
- .2 Copper press fittings shall be installed using the proper tool, actuator, jaws and rings as instructed by the press fitting manufacturer.
- .3 The installation of copper tubing for hot and cold water distribution systems shall conform to the requirements of the National Plumbing Code of Canada.

.4 PVC / CPVC Piping Systems.
- .1 Installer shall be certified and trained by the PVC / CPVC system manufacturer.

.2 All joints shall be solvent welded per manufacturers procedure using recommended primer and cement.

.5 Roll Grooved Piping Systems.

.1 Grooving shall be performed using manufacturers approved Rolled Groving tools, and conform to manufacturers tolerances.

.2 Installer shall be trained and qualified in the use of grooved mechanical piping systems.

1.8 APPROVED EQUIPMENT

.1 KITZ
.2 TOYO
.3 RWV
.4 MAS
.5 American Valve

2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 Copper (Above ground): hard drawn, type L: to ASTM B88M.

.2 Copper (Buried or embedded): soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

.3 PEX (Cross-linked Polyethylene) NPS 3 - Less: to ASTM F876 and ASTM F877, S102.2 Plenum Rated, 25/50 Smoke and Flame rated to NPS 3.

.4 CPVC (chlorinated polyvinyl chloride): Schedule 80 for hot water, to ASTM D2846 or ASTM F441, CSA B137.6 compliant.

.5 PVC (polyvinyl chloride) Schedule 80 (cold water only), to ASTM D1785 or CSA B137.3.

2.2 FITTINGS

.1 General:

.1 Fittings shall be suitable for system pressure and temperature ratings, and compative with specified piping materials. All fittings shall be certified for potable water where applicable.

.2 Copper Piping (Type L or K - ASTM B88M).

.1 Solder-Type Fittings:

.1 Cast copper: ANSI/ASME B16.18

.2 Wrought copper: ANSI/ASME B16.22

.2 Threaded and Flanged Fittings:

.1 Bronze threaded: ANSI/ASME B16.15, Bronze flanged (class 150): ANSI/ASME B16.24.

.3 Press-Fit Fittings:

.1 Material: Copper or copper-alloy press fittings with factory-installed sealing elements, listed and certified as a complete system for potable-water service. Fittings, sealing elements, tubing, jaws, rings, and pressing tools shall comply with the fitting manufacturer’s requirements.

.2 Pressure Rating: Minimum 1,600 kPa (232 psi) at 95°C.

.4 Grooved Fittings, to CSA B242, copper tube-sized, do not use IPS-to-copper adapters or flared tube ends.

.3 PEX Piping (ASTM F876/F877)

.1 Expansion Fittings: ASTM F1960, cold expansion type, polymer or brass, listed to CSA B137.5.

.2 Fittings and rings shall be from the same manufacturer as the pipe and approved for potable water use.

.4 CPVC Piping:
  .1 CTS - Size Fittings (Hot & Cold): ASTM D2846.
  .2 Schedule 80 Fittings: ASTM F439 (socket) and F437 (threaded).
  .3 Use only manufacturer-approved solvent cement and primer.
.5 Dielectric Connections:
  .1 Use dielectric unions to ASTM F492 between dissimilar metals to prevent galvanic corrosion.
.6 Provide dielectric isolation kits at all flanged connections between ferrous dissimilar metals (e.g., stainless steel and copper). Kits to include non-conductive full-face gasket, bolt sleeves and insulating washers.

2.3 JOINTS

.1 Soldered Joints (Copper): Use lead-free solder: 95/5 tin-copper alloy conforming to ASTM B32. Use flux compatible with potable water system.
.2 Threaded Joints (Bronze, Brass, Stainless): Use PTFE tape or approved thread sealant. Threads to ANSI B1.20.1. Avoid use on plastic fittings unless rated for threaded connection.
.3 Press-Fit Joints (Copper, Stainless Steel): Use approved press-fit system with EPDM, FKM, or HNBR seals suitable for the application. PRess tolls must be calibrated and approved by the fitting manufacturer. Pressure rating: Minimum 1600 kPa at 95°C for copper; same or better for stainless.
.4 Grooved Joints (Copper and Stainless Steel): Use rigid or flexible couplings with angle bolt pads for alignment, and flush-type EPDM gaskets. Gaskets must be certified to NSF/ANSI 61 for potable water. Couplings must be compativle with copper tube size (CTS) or stainless steel schedule as applicable. Do not flare tube ends to accommodate IPS couplings.
.5 Solvent-Welded Joints (PVC/CPVC): Use primer and solvent cement conforming to ASTM D2564 (PVC) or ASTM F493 (CPVC). Use only with fittings and pipe from the same manufacturer, rated for potable water if required.
.6 Dielectric Joints: Where dissimilar metals meet, provide dielectric unions conforming to ASTM F492. Include thermoplastic liner and insulating washer. Use brass or stainless steel housing as required.
.7 Flanged Joints:
  .1 Gaskets: Full-face or ring-type, 1.6 mm (1/16") thick, non-asbetos compressed fiber, rated to 860 kPa and 110°C, suitable for potable water. Latex-free.
  .2 Bolts and Nuts: ASTM A307 Grade B carbon steel, zinc-plated or stainless steel where exposed to moisture. Heavy series hex head bolts and nuts.
  .3 Washers: Flat washers, same material as bolts.
.8 Provide mechanical transition fittings between CPVC/PVC and copper or stainless steel, including ANSI 150 flange adapters or unions with NSF 61 certification and appropriate pressure rating for the system.

2.4 GLOBE VALVES

.1 NPS2 and under, soldered:
  .1 To ASTM B62, Class 125, lead free less than .25%, cast bronze body, metal disc, screwed over bonnet, union type hex shoulders. Non asbestos packing, bronze stem, nonferrous handwheel with bronze nut, regrindable bronzed seat.
  .2 Lockshield handles: as indicated.
.2 NPS 2 and under, screwed:
  .1 To ASTM B62, Class 150, bronze body, screwed over bonnet union type hex shoulders,renewable composition disc, non asbestos packing, bronze stem, nonferrous handwheel with bronze nut, regrindable bronzed seat.
  .2 Lockshield handles: as indicated.

2.5 SWING CHECK VALVES

.1 NPS 2 and under, soldered or screwed:

.1 To MSS-SP-80, Class 125, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 NPS 2-1/2 and over, flanged:

.1 To MSS-SP-71, Class 125, cast iron body, flat flange faces, regrind seat, bronze disc, bolted cap.

.3 PVC/CPVC Ball Check:

.1 PVC/CPVC to ASTM D1784, true union slip out design with Precision Machined Ball, square cut seat, socket ends to ASTM D2467 sch 80, flange to ANSI class 150, EPDM,or FKM (Viton) seals, NSF/ANSI 61

2.6 BALL VALVES

.1 NPS 2 and under, screwed Soldered/PEX:

.1 Class 150/ANSI/ASME B16.14.

.2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle full port.

.2 CPVC and PVC Piping Systems:

.1 PVC/CPVC to ASTM D1784, true union, full port two way shut off, o ring, stem seal with blowout proof stem, lockable polypropylene handle, threaded union nuts, removable seal carriers, FPOM/FKM (Viton) seals, NSF61, socket sch 80 to ASTM D2467, threaded sch 80 to ASTM D2464, flange ANSI class 150.

.2 Stainless Steel:

.1 To M55 - SP-110, ASME B16.34 where applicable.

.2 Two piece, full port design, blow out proof stem, ASTM A351, grade CF8M stainless steel, 316 SS ball, full port PTFE or RTFE seats, 316 SS stem, PTFE stem seals, NPT thread, 200 psi CWP.

.3 Lockable handle adjustable gland nut.

2.7 BUTTERFLY VALVES

.1 NPS 2-1/2 and over, wafer or lug:

.1 To MSS-SP-67, Class 200 Wafer or lug style, ductile iron body, stainless disc, EPDM liner, aluminum bronze.

.2 NPS 2-1/2 and over, grooved ends:

.1 To MSS-SP-67,Class 300, grooved body, stainless steel disc, EPDM seat, compatible with groove piping system, suitable for bi-directional dead end service, full vacuum,NSF/ANSI 372. Brass body for copper, SS body for SS trim/stem. Lever lock handle, stem extensions for insulation.

2.8 BALANCING VALVES

.1 860 kPa (125 psig) lead free less than .25%, brass body, fixed orifice design, precision adjustable handwheel, integral memory stop.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with NPC and local authority having jurisdiction.

.2 Install pipe work in accordance with Section 23 05 05 Installation of Pipework.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Grooved joint couplings and fittings to be installed in accordance with the manufacturer's written installation instructions. Grooved ends to be clean and free from indentations, projections and roll marks in the area from pipe end to groove. Gaskets to be verified as suitable for the intended service prior to installation. Gaskets to be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative to provide on-site training for Contractor's field personnel in the use of grooving tools, application of groove and installation of groove, and installation of grooved

joint products. The manufacturer's representative to periodically visit the jobsite and review installation. Contractor to move and replace any joints deemed improperly installed.

.5 Press Fit Piping: Prepare copper tube and install in strict accordance with installation instructions. Pipe ends to be cleaned, free from indentations, projections, burrs, and foreign matter. Use a tube preparation tool to clean and make installation mark. Push copper tube into fittings to installation depth mark, per installation instructions. Keep fittings free of dirt and oil.

.6 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.7 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.8 Install pipe work in accordance with Section 23 05 05 -Installation of Pipework and by certified Journey Person supplemented as specified herein.

.9 PEX Potable Water Distribution:

.1 Install PEX tubing in accordance with tubing manufacturer's recommendations, installation manuals and technical bulletins and as indicated on Contract Drawings.

.2 PEX tubing shall not be exposed to direct sunlight for more than 30 days.

.3 Insulation must cover the PEX tubing when exposed to a direct UV light source such as fluorescent light bulbs or any UV generating device.

.4 Ensure that no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tube manufacturer.

.5 PEX tubing passing through structural concrete slabs shall be pre-sleeved with corrugated polyethylene as supplied by the manufacturer.

.6 PEX tubing passes through metal studs shall use grommets or sleeves at the penetration.

.7 Protect PEX tubing with sleeves where abrasion may occur.

.8 Use strike protectors where PEX tubing has the potential for being struck with a screw or a nail.

.9 Bends are preferred to elbows where space allows. Manufacturer's bend supports shall be used where bends are less than six (6) times outside pipe diameter.

.10 All horizontal runs of 1" and greater PEX tubing runs shall be supported by PEX-a galvanized support channels. Install as per manufacturer's recommendations with additional supports where required.

.11 All fitting connections to the PEX tubing shall be made to the requirements ASTM F1960.

.12 Multi-port Tee's shall be used in-suite wherever possible instead of straight or reduced tee's to minimize pressure drops in the plumbing distribution system.

.13 A mid-story support shall be installed in all PEX risers.

.14 An epoxy coated riser clamp shall be installed on top of every floor and against every second ceiling for all PEX risers.

.15 Manufacturer's wall penetration brackets shall be used at all wall membrane penetrations.

.10 Buried Tubing:

.1 Lay in well completed washed sand in accordance with AWWA Class B bedding.

.2 Bed tubing without crimping or constriction. Minimized us of fittings.

.3 Buried fittings shall be approved for direct burial by the manufacturer and not affect the warranty period or benefits.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with butterfly or ball valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section 20 05 01 - Common Work Results - Mechanical
.2 Test pressure: greater of 1-½ times maximum system operating pressure or 860 kPa.

3.4 FLUSHING AND CLEANING

.1 Flush entire system for eight (8) hours. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory bacterialogical and chemical testing to verify that system is clean to provincial potable water guidelines. Let system flush for additional two (2) hours, then draw off another sample for testing.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.
.2 Verify that system can be completely drained.
.3 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Consultant.
.2 Upon completion, provide laboratory test reports on water quality for Consultant approval.

3.7 START-UP

.1 Timing: Start up after:
  .1 Pressure tests have been completed.
  .2 Disinfection procedures have been completed.
  .3 Water treatment systems operational.
.2 Provide continuous supervision during start-up.
.3 Start-up procedures:
  .1 Establish circulation and ensure that air is eliminated.
  .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
  .3 Bring HWS storage tank up to design temperature slowly.
  .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
  .5 Check control, limit, safety devices for normal and safe operation.
.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Timing:
  .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
.2 Procedures:
  .1 Verify that flow rate and pressure meet Design Criteria.
  .2 TAB DHWR in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
  .4 Sterilize DHW and DHWR systems for Legionella control.
  .5 Verify performance of temperature controls.
  .6 Verify compliance with safety and health requirements.
  .7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.

.8 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

.9 Confirm proper installation and functioning of all valves.

.3 Reports:

.1 In accordance with Division 01 - General Requirements: using report forms as specified.

.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

.3 Chemical and biological water testing report.

.4 Valve commissioning check list.

.5 Pressure testing report signed off by Contractor and witness for each section of piping tested.

.6 Flushing and cleaning report signed off by Contractor and witness for each section of piping.

3.9 TRAINING

.1 Provide training including location and function of all valves, procedure for draining, shutdown, flushing and disinfection procedure, basic troubleshooting, access and maintenance for valves and specialty fittings.

END OF SECTION

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1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CSA C22.2 No. 110, Electric Storage Tank Water Heaters.
- .2 CAN/CSA-C191, Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service, where applicable.
- .3 CSA C309, Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service, where applicable.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.
.2 Submit product data and shop drawings in accordance with Division 01.
.3 Indicate storage capacity, heating input, recovery capacity at scheduled temperature rise, tank working pressure, dimensions, operating weight, connection sizes and locations, relief-valve rating, insulation, jacket, controls, and service clearances.
.4 Indicate electrical characteristics, including voltage, phase, frequency, full-load current, number and rating of elements, element staging, control power requirements, disconnect requirements, and wiring diagram.
.5 Identify factory-installed and field-installed components.
.6 Indicate required supports, anchorage, housekeeping pad, and seismic restraint provisions, where applicable.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Division 01 - General Requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - General Requirements.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.

1.5 WARRANTY

.1 Provide manufacturer’s minimum three-year warranty for the complete water heater, commencing at Substantial Performance of the Work.
.2 Warranty shall include the storage tank against leakage resulting from defects in materials or manufacture.
.3 Submit manufacturer’s warranty certificate as a closeout submittal.

2 Products

2.1 ELECTRIC

.1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309 for glass-lined storage tanks, with immersion type elements, kW rating as indicated, and surface mounted or immersion type adjustable thermostats.
.2 Tank: Glass-lined steel with replaceable sacrificial anode, or welded stainless steel suitable for potable-water service. Tank construction and pressure rating shall be suitable for the scheduled working pressure and temperature.

.3 Storage capacity, heating input, recovery rate, electrical characteristics, and dimensions: as indicated in the equipment schedule.
.4 Factory-insulated tank complying with NECB 2020.
.5 Acceptable Manufacturers: Bradford-White, John Wood, A.O. Smith.

2.2 TRIM AND INSTRUMENTATION

.1 Drain valve: NPS 1 with hose end.
.2 Thermometer to Section 23 05 21 - Thermometers and Pressure Gauges.
.3 Pressure gauge to Section 23 05 21 - Thermometers and Pressure Gauges.
.4 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
.5 Supply anchor bolts and templates for installation by other Divisions.
.6 For glass-lined steel tanks, provide manufacturer’s standard replaceable sacrificial anode system. Anodes not required with stainless-steel tanks unless required by the manufacturer.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.
.2 Provide structural steel for horizontal mounted tanks.
.3 Provide insulation between tank and supports.
.4 Install oil burning domestic water heaters in accordance with CAN/CSA-B139.
.5 Install natural gas fired domestic water heaters in accordance with CSA-B149.1.
.6 Install propane gas fired domestic water heaters in accordance with CSA-B149.2.

3.2 STARTUP AND PERFORMANCE VERIFICATION

.1 Start up the water heater in accordance with the manufacturer’s written instructions.
.2 Do not energize heating elements until the tank is full of water and air has been vented.
.3 Verify correct supply voltage, phase, element current, thermostat operation, high-temperature limit operation, and absence of leakage.
.4 Verify storage-temperature setpoint, recovery operation, and operation of associated recirculation and mixing controls.
.5 Submit completed manufacturer’s startup checklist.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM).
  .1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
  .2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
.2 Canadian Standards Association (CSA International).
  .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
  .2 ASME A112.6.3-2022/ CSA B79.3:22 Floor Drains.
  .3 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
  .4 ASME A112.36.2-2022/B79.2:22, Cleanouts.
.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Safety Data Sheets (SDS).

1.2 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
  .2 Indicate dimensions, construction details and materials for specified items.
  .3 Submit WHMIS MSDS material safety data sheets. Indicate VOC's for adhesive and solvents during application and curing.
.3 Instructions: submit manufacturer's installation instructions.
.4 Manufacturers' Field Reports: manufacturers' field reports specified.
.5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Division 01 - General Requirements, include:
  .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
  .2 Details of operation, servicing and maintenance.
  .3 Recommended spare parts list.

1.3 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.
.5 Fold up metal banding, flatten and place in designated area for recycling.

2 Products

2.1 FLOOR DRAINS

.1 Floor Drains and Trench Drains: to ASME A112.6.3-2022/ CSA B79.3:22.
.2 Type 1: general duty; cast iron body round, adjustable head, 125 mm, sediment basket, nickel bronze strainer, integral seepage pan and trap primer connection.

.1 Acceptable Material: Zurn ZN-415-B5-P, J.R. Smith, Mifab, Watts.

.3 Type 2: heavy duty; cast iron body, heavy duty non-tilting or hinged lacquered cast iron grate, integral seepage pan, trap primer connection, and clamping collar.
.1 Acceptable Material: Zurn ZN-536-P-Y, J.R. Smith, Mifab, Watts.

.4 Type 3: combination funnel floor drain; cast iron body with integral seepage pan, trap primer connection and nickel-bronze adjustable head strainer with integral funnel.
.1 Acceptable Material: Zurn ZN-415-BF-P, J.R. Smith, Mifab, Watts.

2.2 ROOF DRAINS

.1 Type 1: Standard coated roof drain with cast iron body 381 mm diameter, with polyethylenedome, under-deck clamp to suit roof construction, flashing clamp ring with integral gravelstop.
.1 Acceptable Material: Zurn Z-100-C, J.R. Smith, Mifab, Watts.

.2 Type 2: parapet or scupper drain; cast iron body with bronze strainer/grate and flashingclamp.
.1 Acceptable Material: Zurn Z-187, J.R. Smith, Mifab, Watts.

2.3 CLEANOUTS

.1 General
.1 Cleanouts: to ASME A112.36.2-2022/B79.2:22, Cleanouts. Provide at bases of stacks, at changes of direction, and at intervals as required by Code.
.2 Plugs: brass or bronze taper-thread, gas-tight, with square or countersunk head as appropriate.

.2 Floor Cleanouts:
.1 Body: cast iron with adjustable housing and flashing clamp where occurring in wet areas.
.2 Tops: nickel bronze secured tops (flush head) in public/clinical areas; stainless steel tops in wet rooms and food/clean areas (-ZS).
.3 Duty: medium-duty tops in corridors/clinical spaces (ZB/ZN); heavy-duty/traffic-rated tops in service/mechanical areas (-HD), coordinate with structural if slab-on-grade.
.4 Features: vandal-resistant screws where accessible to public (-VP); resilient or O-ring gasket for gas-tight seal (-SG).
.5 Height/Finish: set tops flush with final floor finish (recess rings (-T/-TX/-X/-Z) to suit floor finish). Provide extension sleeves/risers to suit finish thickness.
.6 Waterproofing: provide flashing clamp and sealant compatible with floor waterproofing where applicable (-KC).
.7 Acceptable material: Zurn ZN-1400 series (adjustable secured top), or equal.

2.4 BACK FLOW PREVENTERS

.1 Preventers: to CSA-B64 Series, application as indicated.
.1 Reduced Pressure Principle Type: up to NPS 10 c/w isolation valves on inlet and outlet, two independent check valves, test cocks, internal relief valve, acess cover, inlet strainer and air gap drain.
.1 Acceptable Material: Watts 909, Conbraco, Wilkins 375 or 975.

.2 Double Check Valve Assembly: up to NPS 12 c/w isolation valves on inlet and outlet, two independent check valves, test cocks and inlet strainer.
.1 Acceptable Material: Watts 007 or 774, Conbraco, Wilkins 350 or 950.

2.5 VACUUM BREAKERS

.1 Breakers: to CSA-B64 Series, vacuum breaker atmospheric.
.1 Acceptable Material: Watts 288A, Zurn 35, J.R. Smith, Mifab.

2.6 PRESSURE REGULATORS

.1 Capacity: as indicated.
.1 Inlet pressure: 1034 kPa.

.2 Outlet pressure: 413 kPa.
.3 Capacity: as indicated.
.2 Up to NPS1-1/2 bronze bodies, screwed: to ASTM B62.
.3 NPS2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.
.4 Semi-steel spring chambers with bronze trim.
.5 Acceptable material: Watts LF 25 AUB.

2.7 WATER MAKE-UP ASSEMBLY

.1 Complete with backflow preventer, pressure gauge on inlet and outlet, pressure reducing valve to CSA B356, pressure relief valve on low pressure side, strainer on inlet and gate valves on inlet and outlet.
.1 Acceptable material: Watts LFU5B-Z3B, Zurn 600 x LHTSTSC.

2.8 TRAP SEAL PRIMERS

.1 For single fixtures only: Brass, with integral vacuum breaker, NPS1/2 solder ends, NPS1/2 drip line connection.
.1 Acceptable material: Precision plumbing products PR-500, Mifab MR-500
.2 Up to four fixtures: Metered water quantity from distribution unit. Locate maximum 3 m from fixture.
.1 Acceptable material: Precision plumbing product, PI-5006/w DV-4, Mifab M2-500 c/w MI-DU
.3 Up to 12 fixtures: Electronic trap priming manifold with:
.1 Backflow Preventer or Air Gap
.2 Pre-set 24 hour time clock
.3 Manual override switch
.4 120V solenoid valve
.5 120V or 3-wire connection
.6 NPS 3/4 inlet connection
.7 Calibrated manifold
.8 Water hammer arrestor
.9 Mounted in steel cabinet
.10 Compression outlet fittings
.11 Inlet shutoff valve
.12 Supplies minimum 59 ml at 138 kPa.
.1 Acceptable material: Mifab MI-300, Zurn Z1020XL.

2.9 STRAINERS

.1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
.2 NPS2 and under, bronze body, screwed ends, with brass cap, tapped blow-off connection and plug.
.3 NPS2 1/2 and over, cast iron body, flanged ends, with bolted cap and tapped blow-off connection with bronze ball valve.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada, and.
.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.4 BACK FLOW PREVENTORS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code or the Authority Having Jurisdiction.
    .1 Reduced pressure type where backflow would constitute health hazard.
    .2 Double check type where backflow would constitute a nuisance or be aesthetically objectionable or material which would not constitute a health hazard.
.2 Pipe discharge to terminate over nearest drain and/or service sink.

3.5 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.
.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Consultant.
.3 Install PEX piping to floor drain or fixture.

3.6 STRAINERS

.1 Install with sufficient room to remove basket.

3.7 WATER MAKE-UP ASSEMBLY

.1 Install on valved bypass.
.2 Pipe discharge from relief valve to nearest floor drain.

3.8 START-UP

.1 General:
    .1 In accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, supplemented as specified herein.
.2 Timing: start-up only after:
    .1 Pressure tests have been completed.
    .2 Disinfection procedures have been completed.
    .3 Certificate of static completion has been issued.
    .4 Water treatment systems operational.
.3 Provide continuous supervision during start-up.

3.9 TESTING AND ADJUSTING

.1 General:
    .1 In accordance with Division 01 - General Requirements, supplemented as specified.
.2 Timing:
    .1 After start-up deficiencies rectified.
    .2 After certificate of completion has been issued by authority having jurisdiction.
.3 Application tolerances:
    .1 Pressure at fixtures: +/- 70kPa.
    .2 Flow rate at fixtures: +/- 20%.
.4 Adjustments:
    .1 Verify that flow rate and pressure meet design criteria.
    .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
.5 Floor drains:
    .1 Verify operation of trap seal primer.

.2 Prime, using trap primer. Adjust flow rate to suit site conditions.
.3 Check operations of flushing features.
.4 Verify that strainers are secure, accessible, and removable for cleaning.
.5 Clean out baskets.

.6 Vacuum breakers, backflow preventers, backwater valves:
.1 Test tightness, accessibility for O&M of cover and of valve.
.2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
.3 Verify visibility of discharge from open ports.

.7 Access doors:
.1 Verify size and location relative to items to be accessed.

.8 Cleanouts:
.1 Verify covers are gas-tight, secure, yet readily removable.

.9 Wall, Ground hydrants:
.1 Verify complete drainage, freeze protection.
.2 Verify operation of vacuum breakers.

.10 Pressure regulators, PRV assemblies:
.1 Adjust settings to suit locations, flow rates, pressure conditions.

.11 Strainers:
.1 Clean out repeatedly until clear.
.2 Verify accessibility of cleanout plug and basket.
.3 Verify that cleanout plug does not leak.

.12 Grease interceptors:
.1 Activate, using manufacturer's recommended procedures and materials.

.13 Hose bibbs, sediment faucets:
.1 Verify operation at all low points.

.14 Hydronic system water Make-up Assembly:
.1 Verify operation.

.15 Commissioning Reports:
.1 In accordance with Division 01 - General Requirements, supplemented as specified.

.16 Training:
.1 In accordance with Division 01 - General Requirements: Training of O&M Personnel, supplemented as specified.
.2 Demonstrate full compliance with Design Criteria.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section includes:
  .1 The supply and installation of washroom fixtures and trim.
.2 Products installed but not supplied under this Section:
  .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
  .2 Equipment installed by others:
    .1 Connect with unions.
  .3 Equipment not installed:
    .1 Capped for future connection by others.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
  .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
  .2 CAN/CSA-B125-01, Plumbing Fittings.
  .3 CSA Standards\CSA-B561-04, Barrier-Free Design.

1.3 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.
.3 Submit shop drawings and product data in accordance withDivision 01 - General Requirements.
.4 Indicate fixtures and trim:
  .1 Dimensions, construction details, roughing-in dimensions.
  .2 Factory-set water consumption per flush at recommended pressure.
  .3 For water closets, urinals: minimum pressure required for flushing.
.5 Closeout Submittals:
  .1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Division 01 - General Requirements.
  .2 Include:
    .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
    .2 Details of operation, servicing, maintenance.
    .3 List of recommended spare parts.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.5 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:
  .1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
  .2 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  .3 Fold up metal banding, flatten and place in designated area for recycling.

1.6 ACCEPTABLE MATERIAL

.1 Fixtures: American Standard, AMI Novanni, Eljer, Toto, Kindred, Caroma, Kohler, Zurn.

.2 Trim: Delta, Chicago Faucets, Powers, Crane, Sloan, Zurn.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
.3 Exposed plumbing brass to be chrome plated.
.4 Number, locations: architectural drawings to govern.
.5 Fixtures in any one location to be product of one manufacturer and of same type.
.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 WATER CLOSETS:

.1 WC-1 : Floor-mounted, flush tank, barrier-free.
  .1 Top of seat to comply with barrier-free mounting requirements.
  .2 Bowl: vitreous china, floor mounted, elongated rim, close-coupled.
  .3 Closet tank: vitreous china with factory insulation, locking tank to 4.8 litres/flush (1.28 USG/flush).
  .4 Flush lever: right or left side as indicated on drawings.
  .5 Provide chrome plated rigid supply, vandal-resistant angle stop, waxless ring and required mounting accessories.
  .6 Seat: heavy-duty moulded plastic, closed front with cover.
  .7 Acceptable Material: American Standard Cadet Pro, elongated, EverClean, or approved equal.
.2 Water Closet Seats
  .1 WC-1: heavy-duty, closed front, with cover. Acceptable Material: Centoco 800STS-001 or approved equal.

2.3 WASHROOM LAVATORIES:

.1 L-1: wall-hung, barrier-free.
  .1 Vitreous china, single centre faucet hole, overflow, half pedestal, concealed supports and barrier-free configuration.
  .2 Provide concealed arm wall carrier.
  .3 Acceptable Material: Zurn Z5321-PED.
.2 Washroom Lavatory:
  .1 Barrier-free faucet:
    .1 Slow close metering faucet.
    .2 Chrome plated construction.
    .3 Flow rate: 1.9 litres/minute (0.5 USGPM).
    .4 Acceptable Material: Delta 87T105.
.3 Tempered Water:
  .1 Provide point-of-use thermostatic mixing valve at lavatories as 605B115.002.
  .2 Acceptable Material: Watts LFUSG-B-M3 or approved equal.
.4 Fixture Piping:
  .1 Hot and cold water supplies to fixtures:
    .1 Chrome plated flexible metal supply pipes with screw driver stop, reducer, escutcheon.
  .2 Waste:
    .1 Brass P trap with clean out on fixtures not having integral trap.
    .2 Chrome plated in exposed places.
    .3 Escutcheon to properly cover all exposed pipe & fittings through the wall.
.5 Chair carriers:
  .1 Factory manufactured floor-mounted carrier systems for wall-mounted fixtures.
  .2 Acceptable material: J.R. Smith or Equal.

3 Execution

3.1 INSTALLATION

.1 Mounting heights:
- .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
- .2 Wall-hung fixtures: as indicated, measured from finished floor.
- .3 For barrier-free washroom: to comply with most stringent of either NBCC or CAN/CSA B651.

3.2 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Adjust flush valves to suit actual site conditions.
- .4 Adjust urinal flush timing mechanisms.
- .5 Automatic flush valves for WC's and urinals: set controls to prevent unnecessary flush cycles during silent hours.

.3 Checks:
- .1 Water closets, urinals: flushing action.
- .2 Aerators: operation, cleanliness.
- .3 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:
- .1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
  .1 The supply and installation of drinking fountains and coolers.
.2 Products installed but not supplied under this Section:
  .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
  .2 Equipment installed by others:
    .1 Connect with unions.
  .3 Equipment not installed.
    .1 Capped for future connection by others.

1.2 REFERENCES

.1 Air-Conditioning and Refrigeration Institute (ARI).
  .1 ARI 1010-02, Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.
.2 Canadian Standards Association (CSA International).
  .1 CAN/CSA-B45 Series, CSA Standards on Plumbing Fixtures.
  .2 CAN/CSA-B125, Plumbing Fittings.
  .3 CSA Standards\CSA-B561, Barrier-Free Design.

1.3 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 62 00.01 - Hazardous Materials.
.3 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .1 Indicate, for all fixtures:
    .1 Dimensions, construction details, roughing-in dimensions.
.4 Closeout Submittals:
  .1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Division 01 - General Requirements.
  .2 Include:
    .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
    .2 Details of operation, servicing, maintenance.
    .3 List of recommended spare parts.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.5 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:
  .1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
  .2 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  .3 Fold up metal banding, flatten and place in designated area for recycling.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
.3 Exposed plumbing brass to be chrome plated.
.4 Number, locations: Architectural drawings to govern.
.5 Drinking fountains:
  .1 DF-1 : recessed with elevated bubbler base, integral strainer, wall screws with washers and cap nuts.
    .1 Trim: chrome plated angle stream anti-squirt bubbler with automatic stream regulator, self-closing valve, screwdriver stop, waste tailpiece, trap, in-line strainer, chrome plated waste strainer.
  .2 DF-2 : wall hung barrier free drinking fountain made of 14 gauge Type 304 stainless steel with satin finish
    .1 Trim: angle stream anti-squirt bubbler with automatic stream regulator, self-closing pushbutton valve with front accessible flow adjustment and cartridge, screwdriver stop, vandal-resistant bottom plate and trap integrated inside the basin housing, outside of the wall.
  .3 DF-3 : semi-recessed with elevated base, integral strainer, wall screws.
    .1 Trim: angle stream anti-squirt bubbler with automatic stream regulator, self-closing valve, screwdriver stop, waste tailpiece, trap and access cover.
  .4 DF-4: Universal chilled drinking fountain with bottle filler.
    .1 Model shall deliver 8.0 gph (30 Lph) of 50°F (10 °C) water at 90°F (32°C) ambient and 80 °F (2°C) inlet water.
    .2 Shall include the bottle filler with hands-free activation, fountain shall have push pads to activate the manual flow of water for the cooler.
    .3 Basin shall be designed to eliminate splashing and standing water. Water saver bubbler to reduce wasted water and shall have flexible guard and operate between 20 and 100 PSI (1.4 to 6.9 bar).
    .4 Cabinet finish shall be brushed stainless steel.
    .5 Shall use R-13a refrigerant. Shall comply with ANSI 117.1 and ADA.
    .6 Shall be listed by Canadian Standards.
    .7 Provide filter kit.
    .8 Waterways to be lead free in materials and construction.
    .9 Stainless steel top and heavy-duty galvanized steel frame.
    .10 High efficiency cooling system and refrigerant R-13a.
    .11 External stream height adjustment on the drinking fountain.
    .12 Built-in filter monitor and bottle counter.
    .13 External cold control adjustment.
.6 Refrigerated water coolers:
  .1 RWC-1 : wall mounted barrier free.
    .1 Refrigeration system: packaged hermetic R22 unit with pre-cooler, insulated double wall chiller, storage tank, air-cooled condenser, thermostatically controlled.
    .2 Capacity: 30 L/h from 27 degrees C to 10 degrees C, with 32 degrees C ambient air. In accordance with ARI 1010.
    .3 Cabinet: type 302 stainless steel, satin finish, integral back, strainer, access panel and grille, elevated bubbler base.
    .4 Bubbler: pushbutton operated, self-regulating, angle stream, squirt-proof, with nozzle and guard.
    .5 Electrical: grounded electrical cord with plug: 120 V, 60 Hz. CSA certified.
.7 Fixture piping:
  .1 Hot and cold water supplies to each fixture:

.1 Shut-off valve in supply pipes to each fixture with reducers and escutcheon.
.2 Waste:
.1 Brass P trap with cleanout on each fixture not having integral trap.
.2 Chrome plated in all exposed places.
.8 Chair carriers:
.1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

3 Execution

3.1 INSTALLATION

.1 Mounting heights:
.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
.2 Wall-hung fixtures: measured from finished floor.
.3 Physically handicapped: to comply with most stringent of either NBCC, CAN/CSA B651, or Provincial Building Code Accessibility Act or Regulations.
.2 Drinking fountains and water coolers :
.1 In accordance with ARI 1010.

3.2 ADJUSTING

.1 Conform to water conservation requirements specified this Section.
.2 Adjustments:
.1 Adjust water flow rate to design flow rates.
.2 Adjust water cooler, drinking fountain flow stream to ensure no spillage.
.3 Checks.
.1 Refrigerated water coolers: operation, temperature settings.
.4 Thermostatic controls.
.1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

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1 General

1.1 USE OF SYSTEMS

.1 Use of new permanent heating and/or ventilating systems for supplying temporary heat or ventilation is permitted only under following conditions:
- .1 Entire system is complete, pressure tested, cleaned, flushed out.
- .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
- .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
- .4 There is no possibility of damage from any cause.
- .5 Supply ventilation systems are protected by 60% filters, inspected daily, changed every week or more frequently as required.
- .6 Return systems have approved filters over openings, inlets, outlets.
- .7 All systems will be:
  - .1 Operated as per manufacturer's recommendations and instructions.
  - .2 Operated by Contractor.
  - .3 Monitored continuously by Contractor.
- .8 Warranties and guarantees are not thereby relaxed.
- .9 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Consultant.
- .10 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.

.2 Filters specified in this Section are over and above those specified in other Sections of this project.

.3 Exhaust systems are not included in approvals for temporary heating ventilation.

END OF SECTION

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1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Division 01 - General Requirements.
.2 Shop drawings; submit drawings stamped and signed for review by Owner's representative.
.3 Shop drawings to show:
  .1 Mounting arrangements.
  .2 Operating and maintenance clearances.
.4 Shop drawings and product data accompanied by:
  .1 Detailed drawings of bases, supports, and anchor bolts.
  .2 Acoustical sound power data, where applicable.
  .3 Points of operation on performance curves.
  .4 Manufacturer to certify current model production.
  .5 Certification of compliance to applicable codes.
.5 In addition to transmittal letter referred to in Division 01 - General Requirements: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
.6 Closeout Submittals:
  .1 Provide operation and maintenance data for incorporation into manual specified in Division 01 - General Requirements.
  .2 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.
  .3 Operation data to include:
    .1 Control schematics for systems including environmental controls.
    .2 Description of systems and their controls.
    .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    .4 Operation instruction for systems and component.
    .5 Description of actions to be taken in event of equipment failure.
    .6 Valves schedule and flow diagram.
    .7 Colour coding chart.
  .4 Maintenance data to include:
    .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
    .2 Data to include schedules of tasks, frequency, tools required and task time.
  .5 Performance data to include:
    .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
    .2 Equipment performance verification test results.
    .3 Special performance data as specified.
    .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  .6 Approvals:
    .1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.
    .2 Make changes as required and re-submit as directed by Consultant.
  .7 Additional data:
    .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
  .8 Site records:
    .1 Consultant will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark

changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
- .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
- .3 Use different colour waterproof ink for each service.
- .4 Make available for reference purposes and inspection.

.9 As-built drawings:
- .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
- .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
- .3 Submit to Consultant for approval and make corrections as directed.
- .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Division 01 - General Requirements.
.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.3 MAINTENANCE

.1 Furnish spare parts in accordance with Division 01 - General Requirements as follows:
- .1 One set of packing for each pump.
- .2 One casing joint gasket for each size pump.
- .3 One head gasket set for each heat exchanger.
- .4 One glass for each gauge glass.
- .5 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Division 01 - General Requirements.
.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:
- .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Division 01 - General Requirements.

2 Products

2.1 MATERIALS

.1 All materials used on this project shall be new and CSA approved unless noted otherwise.

3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 00 - Painting.
.2 Prime and touch up marred finished paintwork to match original.
.3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units. Protect open ends of ducts, diffusers, grilles and registers during construction to prevent ingress of dust and dirt into interior of ducts.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Division 01 - General Requirements and submit reports as described in PART 1 - SUBMITTALS above.
  .1 Submit tests as specified in other sections of this specification.

.2 Manufacturer's Field Services:
  .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS above.
  .2 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE above.

3.4 DEMONSTRATION

.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Consultant will record these demonstrations on video tape for future reference.

3.5 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 07 84 00 - Firestopping.
.2 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
.2 CSA Group
  .1 CSA B242:05 (R2025) Groove and Shoulder Type Mechanical Pipe Couplings.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - General Requirements.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
.4 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.
.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
  .1 Unions are not required in installations using grooved mechanical couplings (the coupling shall serve as the union).
.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.
.4 The flexible grooved joint couplings may be used in lieu of a flexible connector at equipment connections for vibration attenuation and stress relief, coupling shall be placed in close proximity to the source of vibration.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.
.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
.3 Terminate drain piping at an approved drainage receptor, service sink, glycol collection system, or other location indicated. Provide an air gap where connected to the plumbing drainage system. Do not discharge glycol or chemically treated water to the drainage system

except where approved by the Owner and authority having jurisdiction. Arrange discharge to be visible and without creating a hazard or causing damage.

.4 Drain valves: NPS 3/4 full port ball valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

.1 Provide and install automatic air vents at accessible high points in piping systems and at air-separation equipment. Elsewhere, provide manual air vents unless automatic vents are specifically indicated.

.2 Install isolation valve at each automatic air valve.

.3 Pipe automatic air-vent discharge to an approved visible location where leakage will not damage building finishes or equipment.

3.5 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Provide dielectric separation where copper or copper-alloy piping is connected directly to ferrous piping or equipment, except where an approved transition fitting or other arrangement prevents detrimental galvanic action.

.3 NPS 2 and under:

.1 Dielectric waterway fitting, dielectric union suitable for the service, or approved transition fitting.

.4 Over NPS 2: Dielectric flange kit or approved dielectric transition fitting.

.5 Dielectric components: Rated for the system pressure, temperature, fluid, and water-treatment chemistry. Provide insulating liners, sleeves, and washers as required to prevent metal-to-metal contact.

3.6 PIPEWORK INSTALLATION

.1 Piping shall be installed by qualified journeypersons or registered apprentices working under their supervision, as required by provincial trade regulations.

.2 Screwed fittings jointed with PTFC threaded seal tape.

.3 Protect openings against entry of foreign material.

.4 Grooved joint couplings and fittings shall be installed in accordance with the manufacturer's written installation instructions.

.1 Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer.

.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, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

.5 Push-to-connect piping: Prepare copper tube and install in strict accordance with installation instructions. Pipe ends shall be cleaned, free from indentations, projections, burrs and foreign matter. Use a tube preparation tool as supplied by the manufacturer to clean and make installation mark. Push copper tube into fittings to installation depth mark, per installation instructions. Keep fittings free of dirt and oil.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible and as indicated.

.11 Ream pipes, remove scale and other foreign material before assembly.

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Provide for thermal expansion as indicated.

.14 Valves:
- .1 Install in accessible locations.
- .2 Remove interior parts before soldering.
- .3 Install with stems above horizontal position unless otherwise indicated.
- .4 Valves accessible for maintenance without removing adjacent piping.
- .5 Install globe valves in bypass around control valves.
- .6 Use ball or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.
- .7 Install butterfly valves on chilled water and related condenser water systems only.
- .8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
- .9 Install ball valves for glycol service.
- .10 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.15 Check Valves:
- .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
- .2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes:
- .1 Provide 12 mm clearance, all around, between sleeve and pipes or between sleeve and insulation.
- .2 Through footings use sleeves large enough to accommodate hub of CI soil pipe.
- .3 Where piping passes below footings, provide minimum all-round clearance of 50 mm between piping and sleeves. Backfill up to underside of footing with concrete of same strength as footing.
- .4 Unless otherwise specified, terminate sleeves flush with walls.
- .5 Sleeves shall be sized to accommodate the insulated pipe diameter.

.5 Installation:
- .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
- .2 Other floors: Terminate 25 mm above finished floor.
- .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:
- .1 Foundation walls and below grade floors: Fire retardant, oakum and waterproof non-hardening mastic or manufactured seals equal to "link seal".
- .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
- .3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
- .4 Ensure no contact between copper pipe or tube and sleeve.

.7 Unless otherwise indicated in Division 7 for pipes passing through roofs, use Thaler Industries Model MEF-3A or MEF-4A aluminum mechanical flashings, height 300 mm. Anchor flashings in roof construction. Install in accordance with manufacturer's recommendations. Make watertight durable joint.

3.8 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.
.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.
.2 Uninsulated unheated pipes not subject to movement: No special preparation.
.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.
.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
.2 Before start-up, clean interior of piping systems in accordance with requirements of Division 01 - General Requirements, supplemented as specified in relevant sections of Division 23.
.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Consultant 48 hours minimum prior to performance of pressure tests.
.2 Pipework: Test as specified in relevant sections of Division 23.
.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Division 23.
.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
.5 Conduct tests in the presence of the Consultant when requested. Perform testing that affects occupied areas or existing operating systems outside normal occupied hours. Testing of isolated new systems may be carried out during regular working hours unless otherwise directed.
.6 Pay costs for repairs or replacement, retesting, and making good. Consultant to determine whether repair or replacement is appropriate.
.7 Do not insulate or conceal piping until testing has been completed, documented, and submitted to the Consultant. Consultant review does not relieve the Contractor of responsibility for the adequacy and integrity of the Work.

3.12 EXISTING SYSTEMS

.1 Protect existing piping, equipment, controls, and services that are to remain. Prevent damage, contamination, blockage, freezing, and unintended interruption of service.
.2 Do not disconnect, shut down, drain, alter, or otherwise interfere with existing systems that are not indicated to be modified without prior authorization from the Consultant.
.3 Coordinate required connections to and interruptions of existing systems with the Consultant. Restore affected systems to normal operation immediately following completion of the Work.
.4 Repair damage to existing systems resulting from the Work. Upon completion, verify that existing systems and components that are to remain are operational and free of leakage, blockage, contamination, and damage.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Electrical motors, belt drives, mechanical couplings, and guards for mechanical equipment and systems.
- .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
- .3 Power wiring, disconnects, starters, and electrical connections shall be provided in accordance with Division 26 and the equipment responsibility schedules. Building automation and control wiring, raceways, and connections shall be provided in accordance with Division 25 and 26. Factory wiring shall be provided by the equipment manufacturer.

1.2 REFERENCES

.1 National Research Council (NRC)
.2 National Energy Code of Canada for Buildings 2020 (NECB 2020)
.3 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- .1 ASHRAE 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.4 National Electrical Manufactures Association (NEMA)
.5 Canadian Standards Association (CSA Group)
- .1 CSA C22.2 No. 100, Motors and Generators.

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

1.3 SUBMITTALS

.1 Submittals: in accordance with Division 01 - General Requirements.
.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Division 01 - General Requirements.
- .2 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of work.
- .3 Closeout Submittals
  - .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Division 01 - General Requirements.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with Provincial Regulations.
.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle in accordance with Division 01 - General Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Division 01 - General Requirements.

2 Products

2.1 GENERAL

.1 Motors shall comply CSA C22.2 and the NECB-2020. Milti-phase motors within the scope of NEMA MG 1 motor-efficiency tables shall have nominal full-load efficiency not less than NEMA Premium efficiency.
.2 Motors integral to listed packaged equipment may comply with the certified efficiency requirements applicable to the complete equipment.
.3 Electronically commutated motors may be used where indicated or supplied as an integral part of equipment, provided motor and controller efficiency and controllability meet the specified equipment performance.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.
.2 Motors under 560 W (3/4 HP): Voltage, phase, speed, as indicated. Unless otherwise indicated, provide single-phase motors with built-in thermal overload protection and minimum service factor of 1.15.
.3 Motors 560 W (3/4 HP) and larger: Three-phase squirrel-cage induction motors, minimum service factor of 1.15, Nema class F insulation, voltage and speed as indicated, unless otherwise specified.
.4 Motor Enclosure
.1 Dry indoor locations: open drip-proof unless otherwise indicated.
.2 Damp, wet, dusty, outdoor, washdown, or corrosive locations: totally enclosed fan-cooled or other enclosure suitable for the environment.
.3 Motors located within an airstream: enclosure and materials suitable for the air-stream conditions and equipment listing.
.4 Hazardous locations: enclosure and certification suitable for the area classification.
.5 Motors operated by variable-frequency drives:
.1 Suitable for inverter duty service in accordance with NEMA MG 1 and the VFD manufacturer’s requirements.
.2 Rated for continuous operation throughout the specified speed and torque range without overheating.
.3 Provide insulation system suitable for the expected peak voltage and voltage rise time at the motor terminals.
.4 Provide shaft-grounding rings. Provide insulated bearings, output reactors, or other bearing-current mitigation where recommended by the motor or VFD manufacturer.
.6 Motor nameplate: Permanently identify manufacturer, model, serial number, rated power, voltage, phase, frequency, full-load current, speed, efficiency, power factor, service factor, enclosure, insulation class, temperature rise, duty rating, frame size, bearing information, and suitability for inverter duty where applicable. Motors shall bear certification markings acceptable to the authority having jurisdiction.

2.3 TEMPORARY MOTORS

.1 Where delivery of the specified motor would delay completion or commissioning, a temporary motor may be used subject to review by the Consultant and written acceptance by the driven-equipment manufacturer. Temporary motors shall match the required voltage, phase, speed, rotation, power, torque characteristics, enclosure, and control method, and shall not overload the driven equipment or electrical system. Replace the temporary motor with the specified motor before acceptance. Re-align, test, and recommission the equipment following replacement.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.
.3 For constant-speed motors smaller than 7.5 kW (10 HP): Provide adjustable-pitch drive sheaves with a minimum adjustment range of plus or minus 10%. Set the sheave near the midpoint of its adjustment range at the scheduled speed. Adjustable-pitch sheaves are not required for equipment controlled by a variable-frequency drive unless specifically recommended by the equipment manufacturer.
.4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
.5 Select initial sheave sizes to operate the equipment at the scheduled duty point. Verify speed and performance during TAB and commissioning. Replace sheaves as required to obtain the specified performance without exceeding the motor nameplate rating, equipment maximum speed, or bearing load limitations.
.6 Select belt drives in accordance with the drive manufacturer’s published selection procedures for the motor power, service factor, speed, starting torque, and driven-equipment duty. Minimum drive rating shall be 1.5 times motor nameplate power unless a higher rating is recommended by the drive or equipment manufacturer.
.7 Motor slide rail adjustment plates to allow for centre line adjustment.
.8 Supply one set of spare belts for each set installed in accordance with Division 01 - General Requirements.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.
.2 Guards for belt drives;
  .1 Expanded metal screen welded to steel frame.
  .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
  .3 38 mm dia holes on both shaft centres for insertion of tachometer.
  .4 Removable for servicing.
.3 Provide means to permit lubrication and use of test instruments with guards in place.
.4 Install belt guards to allow movement of motors for adjusting belt tension.
.5 Guard for flexible coupling:
  .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
  .2 Securely fasten in place.
  .3 Removable for servicing.
.6 Unprotected fan inlets or outlets:
  .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
  .2 Net free area of guard: not less than 80% of fan openings.
  .3 Securely fasten in place.
  .4 Removable for servicing.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install motors, drives, and guards securely in accordance with the equipment and component manufacturers’ written instructions.
.2 Install guards so they are readily removable for servicing and can be returned to their proper position and positively secured after servicing.

.3 Align motors, couplings, belts, and driven equipment within the equipment manufacturer's tolerances.
.4 Verify motor rotation before connecting or operating the driven equipment.
.5 Adjust belt tension in accordance with the belt and equipment manufacturers' recommendations.

3.3 FIELD QUALITY CONTROL

.1 Before starting equipment, verify and document:
  .1 Motor voltage, phase, frequency, and nameplate rating.
  .2 Correct motor rotation.
  .3 Alignment of motors, couplings, sheaves, and driven equipment.
  .4 Belt tension and sheave alignment.
  .5 Correct overload and motor-protection settings.
  .6 Motor current and voltage on each phase under operating load.
  .7 Operating speed.
  .8 Bearing condition and lubrication.
  .9 Operation of guards, disconnects, interlocks, and safety devices.
  .10 VFD parameters and minimum and maximum speed settings where applicable.
.2 Correct phase-current imbalance, abnormal noise, excessive vibration, overheating, belt slip, misalignment, and other deficiencies before acceptance.
.3 Submit start-up and test records with equipment commissioning documentation.

3.4 CLEANING

.1 Proceed in accordance with Division 01 - General Requirements.
.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 - Cast-in-Place Concrete.
.2 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
.3 Section 23 08 01 - Performance Verification Mechanical Piping Systems.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  .2 ASTM A105/A105M, Standard Specification for Carbon Steel Forgings, for Piping Applications.
.2 Canadian Standards Association (CSA Group).
  .1 CSA B214:21, Installation code for hydronic heating systems.
  .2 CSA B51:19, Boiler, pressure vessel, and pressure piping code.

1.3 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Submit product data and indicate for items as applicable:
  .1 Manufacturer, model number, line contents, pressure and temperature rating.
  .2 Rated axial, lateral, and angular movement, identifying whether stated movements may occur concurrently. Include movement limits, spring rates, pressure thrust, cycle life, maximum operating pressure and temperature, test pressure, and allowable installation misalignment.
  .3 Nominal size and dimensions including details of construction and assembly.
.3 Submit maintenance data in accordance with Division 01 - General Requirements.
.4 Data to include:
  .1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

1.4 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect, separate and place in designated containers for reuse packaging Steel in accordance with Waste Management Plan.
.4 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
.5 Fold up metal banding, flatten and place in designated area for recycling.

2 Products

2.1 SLIP TYPE EXPANSION JOINTS

.1 Application: for axial pipe movement, as indicated.
.2 Repacking: under full line pressure.
.3 Body and packing housings: Class 150, 1MPa carbon steel pipe to ASTM A53/A53M, Grade B. Wall thickness to match pipe with raised face slip-on flanges to match pipe.
.4 Provide pipe guides near loops.

.5 Slip or traverse sleeves: carbon steel pipe to ASTM A53/A53M, Grade B, hard chrome plated.
.6 Cold spring loop into place at 50% total expansion.
.7 Anchor base: construction steel, welded to body.
.8 Radius of loop if using welding fittings should be six times the diameter of the pipe.
.9 Guides (internal and external): embody into packing housing with concentric alignment of slip or traverse sleeve with packing housing.
.10 Extension limit stop: stainless steel, to prevent over-extension with accessible and removable pins.
.11 Packing rings: 6 minimum, PTFE impregnated non-asbestos.
.12 Thermal plastic packing: PTFE impregnated non-asbestos slug supplied loose.
.13 Lubricating fittings: pet cocks with grease nipple.
.14 Plunger body and plunger:
  .1 Plunger body: heavy wall carbon steel welded to body.
  .2 Plunger: carbon steel with hex head for use with socket wrench.
.15 Lubricant: to manufacturer's recommendations.
.16 Lubricant gun: complete with hose assembly.
.17 Drip connection: 20 MPa forged steel to ASTM A105/A105M. Include half coupling with drain plug.

2.2 BELLOWS TYPE EXPANSION JOINTS

.1 For axial, lateral or angular movements, as indicated.
.2 Maximum operating pressure: same as pipe rating.
.3 Maximum operating temperature: same as pipe rating.
.4 Type A: controlled or free flexing, factory tested to 1 1/2 times maximum working pressure. Furnish test certificates.
.5 Type B: externally pressurized, constant volume, pressure balanced, designed to eliminate pressure thrust, factory tested to 1 1/2 times maximum working pressure. Furnish test certificates.
.6 Bellows:
  .1 Multiple bellows, hydraulically formed, single or two ply, austenitic stainless steel, monel or inconel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.
.7 Reinforcing or control rings:
  .1 2 piece nickel iron.
.8 Ends:
  .1 Raised face, slip-on or weld neck flanges to match pipe.
.9 Liner:
  .1 Austenitic stainless steel in direction of flow.
.10 Shroud:
  .1 Carbon steel, painted.

2.3 FLEXIBLE CONNECTION

.1 Application: to suit motion as indicated.
.2 Minimum length in accordance with manufacturer's recommendations to suit offset.
.3 Inner hose: bronze or stainless steel corrugated.
.4 Braided wire mesh bronze or stainless steel outer jacket.
.5 Diameter and type of end connection: threaded or flanged same as pipe joint for the pipe size.
.6 Operating conditions:
  .1 Working pressure: 1034 kPa.
  .2 Working temperature: To match system requirements.

2.4 ANCHORS AND GUIDES

.1 Anchors:
  .1 Provide as indicated.

.2 Alignment guides:
  .1 Provide as indicated
  .2 Concrete: to Section 03 30 00 - Cast in Place Concrete.
  .3 Reinforced: to Section 03 20 00 - Concrete Reinforcing.

3 Execution

3.1 INSTALLATION

.1 Install expansion joints with cold setting. Make record of cold settings.
.2 Install expansion joints and flexible connections in accordance with manufacturer's instructions.
.3 Install pipe anchors and guides as indicated. Anchors to withstand 150 % of axial thrust.

3.2 CLEANING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

3.3 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification Mechanical Piping Systems: Mechanical Piping Systems.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 23 05 05 - Installation of Pipe Work.
.2 Section 23 21 13 - Hydronic Systems: Steel.

1.2 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  .1 ANSI/ASME B31.1-, Power Piping.
  .2 ANSI/ASME B31.3-, Process Piping Addenda A.
  .3 ANSI/ASME B31.3-, Process Piping Addenda B.
  .4 ANSI/ASME Boiler and Pressure Vessel Code-:
    .1 Section I: Power Boilers.
    .2 Section V: Nondestructive Examination.
    .3 Section IX: Welding and Brazing Qualifications.
.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  .1 ANSI/AWWA C206-, Field Welding of Steel Water Pipe.
.3 American Welding Society (AWS)
  .1 AWS C1.1-, Recommended Practices for Resistance Welding.
  .2 AWS Z49.1-, Safety Welding, Cutting and Allied Process.
  .3 AWS W1-, Welding Inspection Handbook.
.4 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-48.2-, Spot Radiography of Welded Butt Joints in Ferrous Materials.
.5 Canadian Standards Association (CSA International)
  .1 CSA W47.2-, Certification of Companies for Fusion Welding of Aluminum.
  .2 CSA W48 series-, Filler Metals and Allied Materials for Metal Arc Welding.
  .3 CSA B51-, Boiler, Pressure Vessel and Pressure Piping Code.
  .4 CSA-W117.2-, Safety in Welding, Cutting and Allied Processes.
  .5 CSA W178.1-, Certification of Welding Inspection Organizations.
  .6 CSA W178.2-, Certification of Welding Inspectors.

1.3 QUALIFICATIONS

.1 Welders
  .1 Welding qualifications in accordance with CSA B51.
  .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
  .3 Furnish welder's qualifications to Consultant.
  .4 Each welder to possess identification symbol issued by authority having jurisdiction.
  .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
.2 Inspectors
  .1 Inspectors qualified to CSA W178.2.

1.4 QUALITY ASSURANCE

.1 Registration of welding procedures in accordance with CSA B51.
.2 Copy of welding procedures available for inspection.
.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - General Requirements, and with the Waste Reduction Workplan.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

3 Execution

3.1 WORKMANSHIP

.1 Welding: in accordance with ANSI/ASME B31.1, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and special procedures specified elsewhere in Division 23 and applicable requirements of provincial authority having jurisdiction (A.H.J.).

3.2 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.
.2 Backing rings:
  .1 Where used, fit to minimize gaps between ring and pipe bore.
  .2 Do not install at orifice flanges.
.3 Fittings:
  .1 NPS 2 and smaller: install welding type sockets.
  .2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Consultant before work is started.
.2 Formulate "Inspection and Test Plan" in co-operation with Consultant.
.3 Do not conceal welds until they have been inspected, tested and approved by inspector.
.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.4 SPECIALIST EXAMINATIONS AND TESTS

.1 General
  .1 Perform examinations and tests by specialist qualified in accordance with CSA W178.1 and CSA W178.2 and approved by Consultant.
  .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
  .3 Inspect and test welds in accordance with "Inspection and Test Plan" by non-destructive visual examination magnetic particle (hereinafter referred to as "particle") tests and/or spot or full gamma ray radiographic (hereinafter referred to as "radiography") tests, as per applicable reference standard or as specified by A.H.J.
.2 Hydrostatically test welds to requirements of ANSI/ASME B31.1.
.3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
.4 Failure of visual examinations:
  .1 Upon failure of welds by visual examination, perform additional testing at no additional expense to project as directed by Consultant.

.5 Full radiographic tests for piping systems.
  .1 Spot radiography to CAN/CGSB-48.2.
    .1 Conduct spot radiographic tests of up to 10% of welds, selected at random by from welds which would be most difficult to repair in event of failure after system is operational.
  .2 Radiographic film:
    .1 Identify each radiographic film with date, location, name of welder, and submit to Consultant. Replace film if rejected because of poor quality.
  .3 Interpretation of radiographic films:
    .1 By qualified radiographer.
  .4 Failure of radiographic tests:
    .1 Extend tests to welds by welder responsible when those welds fails tests.
.6 Magnetic particle tests for piping systems as indicated.

3.5 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.
.2 In addition, chilled water systems below 1000 kPa:
  .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
  .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.
  .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
  .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
  .5 Repair cracks and defects in excess of 0.8 mm in depth.
  .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic or particle tests.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.7 CLAIMS FOR DELAYS

.1 Claims for delays in completion of project will not be entertained for reasons of failure of welds to pass examinations.

END OF SECTION

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1 General

1.1 SECTION INCLUDES

.1 Materials and installation for thermometers and pressure gauges in piping systems.

1.2 RELATED SECTIONS

.1 Section 23 05 54 - Mechanical Identification.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME).
  .1 ASME B40.100, Pressure Gauges and Gauge Attachments.
  .2 ASME B40.200, Thermometers, Direct Reading and Remote Reading.
.2 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
  .2 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.4 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Submit manufacturer's product data for following items:
  .1 Thermometers.
  .2 Pressure gauges.
  .3 Stop cocks.
  .4 Syphons.
  .5 Wells.
.3 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Division 01 - General Requirements.
.2 Collect, separate and place in designated containers for reuse and recycling, paper, plastic, polystyrene, corrugated cardboard packaging, steel, metal, in accordance with Waste Management Plan.
.3 Fold up metal banding, flatten and place in designated area for recycling.
.4 Place materials defined as hazardous or toxic waste in designated containers.
.5 Ensure emptied containers are sealed, labelled and stored safely for disposal away from children.

2 Products

2.1 GENERAL

.1 Design point to be at mid point of scale or range.
.2 Ranges: as indicated.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, liquid filled, accuracy +/- scale division 225 mm scale length: to CAN/CGSB14.4 or ASME B 40, 200.

.1 Acceptable material: Trerice, Ashcroft, Wika, Winters, Marsh.

2.3 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.
.2 Steel pipe: brass.

2.4 REMOTE READING THERMOMETERS

.1 100mm diameter liquid filled or vapor activated dial type: to CAN/CG SB - 14.4 or ASME B40-200, accuracy within one scale division. Brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb, and polished brass or stainless steel case for wall mounting.
  .1 Acceptable material: Trerice, Ashcroft, Wika, Winters, Marsh.

2.5 PRESSURE GAUGES

.1 Dial type 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel or phosphor bronze bourdon tube having 0.5% accuracy full scale, 1% accuracy for liquid filled.
  .1 Acceptable material: Trerice, Ashcroft, Wika, Winters, Marsh.
.2 Provide bronze stop cock and :
  .1 Siphon for steam service.
  .2 Snubber for pulsating operation.
  .3 Diaphragm assembly for corrosive service.
  .4 Gasketed pressure relief back with solid front.
  .5 Oil filled for high vibration applications such as pumps.
  .6 Bronze ball valve to Section 23 05 22 - Valves - Bronze.

3 Execution

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.
.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Install in wells on piping arrange so that at least 25mm (1") of the stem of the thermometer is immersed in flowing fluid. Provide heat conductive material inside well.
.2 Install on inlet and outlet of equipment:
  .1 Heat exchangers.
  .2 Heating and cooling coils.
  .3 Boilers.
  .4 Chillers.
  .5 Cooling towers, closed circuit coolers and evaporative condensers
  .6 DHW tanks.
.3 Install wells in other locations as indicated.
.4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install in following locations:
  .1 Suction and discharge of pumps (liquid filled).
  .2 Upstream and downstream of PRV's.
  .3 Upstream and downstream of control valves.
  .4 Inlet and outlet of coils.
  .5 Inlet and outlet of heat exchanger.

.6 Outlet of boilers.
.7 In other locations as indicated.

.2 Install ball valves to Section 23 05 22 - Valves - Bronze.

.3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

.1 Install engraved lamicoid nameplates as specified in Section 23 05 54 - Mechanical Identification, identifying medium.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Bronze - valves.

1.2 RELATED SECTIONS

.1 Section 23 05 01 - Installation of Pipework.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
  .3 ANSI/ASME B16-22 Wrought Copper and Copper Alloy Soldier Joint Pressure Fittings.
.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A276, Specification for Stainless Steel Bars and Shapes.
  .2 ASTM A536, Specifications for Ductile Iron Castings.
  .3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
  .4 ASTM B16 Specifications for Free Cutting Brass Rod Bar and Shapes for use in Screw Machines.
  .5 ASTM B283, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  .6 ASTM B505/B505M, Specification for Copper-Base Alloy Continuous Castings.
.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS-SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.
  .2 MSS-SP-80, Bronze Gate Globe, Angle and Check Valves.
  .3 MSS-SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
  .4 Canadian Standards Association (CSA)
    .1 CSA B242, Groove and Solder type mechanical pipe couplings.

1.4 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.
  .1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .2 Submit data for valves specified in this section.
  .3 Groove joint couplings and fittings to be indicated on product submittals and to be specifically identified with applicable style or series designation.
.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.5 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.6 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate and recycle waste materials in accordance with Division 01 - General Requirements.
.2 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.7 MAINTENANCE

.1 Extra Materials:
.2 Furnish following spare parts:
.1 Valve seats: one for every 10 valves each size, minimum 1.
.2 Discs: one for every 10 valves, each size. Minimum 1.
.3 Stem packing: one for every 10 valves, each size. Minimum 1.
.4 Valve handles: 2 of each size.
.5 Gaskets for flanges: one for every 10 flanged joints.
.6 Grooved Couplings: IPS and copper tube dimensions, one for every 10 (ten) ground joints.

2 Products

2.1 MATERIALS

.1 Valves:
.1 Except for specialty valves, to be single manufacturer.
.2 All products to have CRN registration numbers.
.2 End Connections:
.1 Connection into adjacent piping/tubing:
.1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.
.2 Copper tube systems:
.1 Solder ends to ANSI/ASME B16.18.
.2 Grooved ends to copper tube dimension and CSMB242
.3 Push-to-connect ends to ANSI/ASME B16.22 and manufacturers standards.
.3 Lockshield Keys:
.1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron

2.2 CHECK VALVES

.1 Requirements common to check valves, unless specified otherwise:
.1 Standard specification: MSS SP-80.
.2 Connections: screwed with hexagonal shoulders.
.1 Class 125, WP = 860 kPa (125 psi) 1.4 MPa (200psi) WOG
.2 Class 150, WP = 1.03 MPa
.3 200 6WP, WP = 1.4 MPa (200psi) Water.
.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
.3 NPS 2 and under, swing type, bronze disc:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
.4 NPS 2 and under, swing type, composition disc, 200 CWP:
.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.
.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

.2 Disc: renewable PTFE for steam, #6 composition rotating disc for water, oil, or gas service in disc holder having guides top and bottom, of bronze to ASTM B62.

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.7 NPS 2 and under vertical on horizontal lift type 1380kPa CWP:
.1 Disc type 301 stainless steel, center guided.

2.3 SILENT CHECK VALVES

.1 NPS 2 and under:
.1 Body: cast high tensile bronze to ASTM B16 or ASTM B62 with integral seat.
.2 Pressure rating: Class 125, MPa Steam.
.3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
.4 Disc and seat: renewable rotating disc.
.5 Stainless steel spring, heavy duty.
.6 Seat: regrindable.

2.4 BALL VALVES

.1 NPS 2 and under:
.1 Body and cap: cast high tensile bronze to ASTM B62.
.2 Pressure rating: Class 125 860 kPa steam.
.3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders, push to connect press fit ends.
.4 Stem: tamperproof ball drive.
.5 Stem packing nut: external to body.
.6 Ball and seat: replaceable stainless steel solid ball of hand chrome plated brass solid ball and teflon seats.
.7 Stem seal: TFE EPDM, Nitrile, Fluoroelastomer with external packing nut.
.8 Operator: removable lever handle.
.9 Cup and drain for service.

2.5 BUTTERFLY VALVES

.1 NPS 2-1/2 through NPS 6.
.1 Body: cast bronze per CDA-836 (85-5-5-5).
.2 Pressure rating: 2065-kPa CWP.
.3 Connections: copper tube dimensioned grooved ends.
.4 Disc: ductile iron per ASTM A536 with elastomer coating.
.5 Stem: integrally cast with disc.
.6 Stem Nuts: nickel plated 416 stainless steel.
.7 Operator: gear operator, NPS and over.

2.6 GATE VALVES

.1 Requirements common to all gate valves, unless specified otherwise:
.1 Standard specification: MSS SP-80.
.2 Bonnet: with hex. shoulders.
.3 Connections: with hex. shoulders.
.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Packing: high grade non-asbestos packing.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.
.8 Class 125, WP = 860 kPa steam, 1.4 mPa WOG.
.9 Class 150 WP = 1.03 mPa steam, 2.07 mPa WOG.

.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125:
.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: Handwheel.

.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
  .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
  .2 Operator: Handwheel.
.4 NPS 2 and under, rising stem, split wedge disc, Class 125:
  .1 Body: with long disc guides, screwed bonnet.
  .2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
  .3 Operator: Handwheel
.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:
  .1 Body: with long disc guides, screwed bonnet.
  .2 Operator: Handwheel.
.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:
  .1 Body: with long disc guides, screwed bonnet.
  .2 Operator: Handwheel.

2.7 GLOBE VALVES

.1 Requirements common to all globe valves, unless specified otherwise:
  .1 Standard specification: MSS SP-80.
  .2 Bonnet: union with hex. shoulders.
  .3 Connections: screwed with hex. shoulders.
  .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
  .5 Packing: non-asbestos.
  .6 Handwheel: non-ferrous.
  .7 Handwheel Nut: bronze to ASTM B62.
  .8 Class 125, WP = 860 kPa steam, 1.4 MPa WOG.
  .9 Class 150 WP = 1.03 mPa steam, 2.07 MPa WOG.
.2 NPS 2 and under, composition disc, Class 125:
  .1 Body and bonnet: screwed bonnet.
  .2 Disc and seat: renewable rotating PTFE disc regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
  .3 Operator: Handwheel.
.3 NPS 2 and under, composition disc, Class 150:
  .1 Body and bonnet: union bonnet.
  .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
  .3 Operator: Handwheel.
  .4 Acceptable material: Jenkins Figure 106BJ or equal.
.4 NPS 2 and under, plug disc, Class 150, screwed ends:
  .1 Body and bonnet.
  .2 Disc and seat ring: tapered plug type with disc stem ring of stainless steel to ASTM A276, loosely secured of stem.
  .3 Operator: Handwheel.
  .4 Acceptable material: Jenkins Figure 2032J or equal
.5 Angle valve, NPS 2 and under, composition disc, Class 150:
  .1 Body and bonnet: union bonnet.
  .2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
  .3 Operator: Handwheel.
  .4 Acceptable material: Jenkins Figure 108BJ or equal.

2.8 ACCEPTABLE MATERIAL

.1 Jenkins, Crane, Watts, Newman Hattersley, Milwaukee, Conbraco, Kitz, Red White, M.A. Stewart, Nibco, Victaulic, Boshart.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.
.2 Remove internal parts before soldering.
.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.
  .1 Unions are not required in Installations using ground mechanical couplings. The couplings shall serve as unions.
.4 Add joining tube, couplings and fittings with grooved joint valves shall be copper tube dimensioned. Tlaring tube or fitting ends to accommodate IPS sized valves is not permitted.

3.2 COMMISSIONING

.1 As part of commissioning activities, develop a schedule and valves and record there on there as identifier, location, services, purchase order number and date, manufacturer, identification data specified above.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Related Sections:
  .1 Section 23 05 01 - Installation of Pipework.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B16.1-, Cast Iron Pipe Flanges and Flanged Fittings.
.2 American Society for Testing and Materials International (ASTM).
  .1 ASTM A49-, Specification for Heat-Treated Carbon Steel Joint Bars.
  .2 ASTM A126-, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .3 ASTM B61-, Specification for Steam or Valve Bronze Castings.
  .4 ASTM B62-, Specification for Composition Bronze or Ounce Metal Castings.
  .5 ASTM B85-, Specification for Aluminum-Alloy Die Castings.
  .6 ASTM B209-, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS SP-67 Butterfly Valves.
  .2 MSS SP-70-, Cast Iron Gate Valves, Flanged and Threaded Ends.
  .3 MSS SP-71-, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  .4 MSS SP-82-, Valve Pressure Testing Methods.
  .5 MSS SP-85-, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.
  .1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .2 Submit data for valves specified in this section.
.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.5 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:
  .1 Separate and recycle waste materials in accordance with Division 01 - General Requirements.
  .2 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.6 MAINTENANCE

.1 Extra Materials:
.2 Furnish following spare parts:
  .1 Valve seats: one for every 10 valves each size, minimum 1.
  .2 Discs: one for every 10 valves, each size. Minimum 1.

.3 Stem packing: one for every 10 valves, each size. Minimum 1.
.4 Valve handles: 2 of each size.
.5 Gaskets for flanges: one for every 10 flanged joints.

2 Products

2.1 MATERIAL

.1 Valves:
  .1 Except for specialty valves, to be of single manufacturer.
.2 Standard specifications:
  .1 Gate valves: MSS SP-70.
  .2 Globe valves: MSS SP-85.
  .3 Check valves: MSS SP-71.
.3 Requirements common to valves, unless specified otherwise:
  .1 Body, bonnet: cast iron to ASTM B209 Class B.
  .2 Connections: flanged ends plain face to ANSI B16.1.
  .3 Inspection and pressure testing: to MSS SP-82.
  .4 Bonnet gasket: non-asbestos.
  .5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.
  .6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
  .7 Gland packing: non-asbestos.
  .8 Handwheel: Die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49. Nut of bronze to ASTM B62.
  .9 Identification tag: with catalogue number, size, other pertinent data.
.4 All products to have CRN registration numbers.
.5 Bronze trim for steam, water, air or glycol services. Iron trim for oil, gas or gasoline.

2.2 GATE VALVES

.1 NPS 2 1/2 - 8, non rising stem, inside screw, bronze or iron trim, solid wedge disc:
  .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly. Class 125.
  .2 Bronze trim.
    .1 Disc: solid offset taper wedge, bronze to ASTM B62.
    .2 Seat rings: renewable bronze to ASTM B62, screwed into body.
    .3 Stem: bronze to ASTM B62.
      .1 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem.
      .2 Seat: Integral with body.
      .3 Stem: wrought steel.
      .4 Operator: Handwheel.
.2 NPS 10 - 24, non rising stem, inside crew, bronze trim, solid wedge disc:
  .1 Body and multiple-bolted bonnet: cast iron to ASTM A126 Class B for sizes up to NPS 14, Class C for sizes NPS 16 and over, with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges.
  .2 Pressure ratings: Class 125.
  .3 Bronze trim.
  .4 Iron trim.
    .1 Disc: solid offset taper wedge, with bronze rings to ASTM B62 rolled into cast iron disc, secured to stem.
    .2 Seat rings: renewable bronze to ASTM B62 screwed into body.
    .3 Stem: bronze to ASTM B62.
      .1 Disc: solid offset taper wedge, cast iron secured to stem.

.2 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.
.3 Stem: wrought steel.
.4 Operator: Handwheel.

.3 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:
.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125.
.2 Bronze trim.
.1 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
.2 Seat rings: renewable bronze screwed into body.
.3 Stem: manganese bronze.
.3 Iron trim.
.1 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.
.2 Seat rings: integral with body.
.3 Stem: nickel-plated steel.
.4 Pressure-lubricated operating mechanism.
.5 Operator: Handwheel.

.4 NPS 10 - 24, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:
.1 Body and multiple-bolted bonnet: NPS 10 - 14: cast iron to ASTM A126 Class B. With bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges, yoke, yoke hub, yoke sleeve and nut.
.2 Pressure ratings: Class 125.
.1 NPS 10-12: WP = 1.4 Mpa CWP.
.2 NPS 14-24: WP = 1.03 Mpa CWP.
.3 Bronze trim.
.1 Disc: solid offset taper wedge, bronze disc rings to ASTM B62 rolled into cast iron disc, secured to stem through integral forged T-head disc-stem connection.
.2 Seat rings: renewable bronze to ASTM B62 screwed into body.
.3 Stem: Manganese bronze
.4 Iron trim.
.1 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.
.2 Seat: integral with body up to NPS 14, renewable nodular iron on other sizes.
.3 Stem: nickel-plated steel.
.4 Pressure-lubricated operating mechanism.
.5 Operator: Handwheel.

2.3 UNDERWRITERS APPROVED GATE VALVE

.1 NPS 2 1/2 - 14, OS&Y:
.1 Approvals: UL and FM approved for fire service.
.2 UL and FM Label: on valve yoke.
.3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to ANSI B16.1 and ULC 262 (B).
.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.
.5 Packing gland: bronze.
.6 Stem: manganese bronze. Diameter to ULC C-262 (B).
.7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B).
.8 Bosses for bypass valve, drain: on NPS 4 and over.

.9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: cast iron with bronze disc rings.
.10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.
.11 Pressure rating:
.1 NPS 2-1/2 - 12: 1.7 Mpa CWP.
.2 NPS 14-1.2: 1.2 MPa CWP.
.12 Operator: handwheel.

2.4 GLOBE VALVES

.1 NPS 2 1/2 - 10, OSY:
.1 Body: with multiple-bolted bonnet.
.2 WP: 860 kPa steam, 1.4 MPa CWP.
.3 Bonnet-yoke gasket: non-asbestos.
.4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.
.5 Seat ring: renewable, regrindable, screwed into body.
.6 Stem: bronze to ASTM B62.
.7 Operator: Handwheel.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.
.2 Position of bypass valve on main valves: spindle uprights or parallel position.
.3 Size of bypass valve:
.1 Main valve up to NPS 8: NPS 3/4.
.2 Main valve NPS 10 and over: NPS 1.
.4 Type of bypass valves:
.1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze. Pressure rating to match main valve.
.2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze. Pressure rating to match main valve.

2.6 VALVE OPERATORS

.1 Install valve operators as follows:
.1 Handwheel: on valves except as specified.
.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in boiler rooms and mechanical equipment rooms.

2.7 CHECK VALVES

.1 Swing check valves, Class 125:
.1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Flanged ends: plain faced with smooth finish.
.1 Up to NPS 16: cast iron to ASTM A126 Class B.
.2 NPS 18 and over: cast iron to ASTM A126 Class C.
.2 Ratings:
.1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.
.2 NPS 14 - 16: 860 kPa steam; 1.03 MPa CWP.
.3 NPS 18 and over: 1.03 MPa CWP.
.3 Bronze trim.
.1 Disc: rotating for extended life.
.1 Up to NPS 6: bronze to ASTM B 62.
.2 NPS 8 and over: bronze-faced cast iron.
.3 Seat rings: renewable bronze to ASTM B62 screwed into body.
.4 Hinge pin, bushings: renewable bronze to ASTM B62.
.4 Iron trim.

.1 Disc: A126 Class B, secured to stem, rotating for extended life.
.2 Seat: cast iron, integral with body.
.3 Hinge pin: exelloy; bushings: malleable iron.
.5 Identification tag: fastened to cover.
.6 Hinge: galvanized malleable iron.

.2 Swing check valves, NPS 2 1/2 - 8 Class 250:
.1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin.
.2 Flanged ends: 2 mm raised face with serrated finish.
.3 Rating: 250 psi steam; 500 psi CWP.
.4 Disc: rotating for extended life.
.1 Up to NPS 3: bronze to ASTM B61.
.2 NPS 4 - 8: Iron faced with ASTM B61 bronze.
.5 Seat rings: renewable bronze to ASTM B61, screwed into body.
.6 Hinge pin, bushings: renewable, bronze to ASTM B61.
.7 Hinge: galvanized malleable iron.
.8 Identification tag: fastened to cover.

2.8 SILENT CHECK VALVES

.1 Construction:
.1 Body: malleable or ductile iron with integral seat.
.2 Pressure rating: class 125, WP = 860 kPa.
.3 Connections: grooved ends or flanged ends.
.4 Disc: bronze or stainless steel renewable rotating disc.
.5 Seat: renewable, EPDM.
.6 Stainless steel spring, heavy duty.
.7 Grooved end check valves.

2.9 GROOVED END BUTTERFLY VALVES

.1 Butterfly valves: to MSS-SP-67. Application: Isolating coils or section of multiple component equipment (eg multi-section coils, multi-cell
.1 NPS 2 cooling towers and over: grooved ends.
.2 2068 kPa WOG and bath bi-directional and dead end service capable to fall rated pressure, ductile iron body with blow-out proof stainless steel stems and nickel coated ductile iron disc. Seat shall be "EPDM" and have a full 360 degree continuous contract with the seating surface.
.3 Valve operations: level, gear operator NPS 6 and over.

2.10 ACCEPTABLE MATERIAL

.1 Jenkins, Crane, Wath, Newman, Hatersley, Milwaukee, Conbraco, Kitz, Red Wine, M.A. Stewart, Nibco, Victaulic.
.2 Grooved end valves to be supplied by the same manufacturer as the grooved fittings.
.3 Grooved end valves to be installed in accordance with the manufacturer's written installation instructions. Grooved ends to be clean and free from indentations and projections. Gaskets to be verified as suitable for the intended service prior to installation. Gaskets to be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative to provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative to periodically visit the jobsite and review installation. Contractor to remove and replace any joints deemed improperly installed.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

3.2 COMMISSIONING

.1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date and manufacturer.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Valves Cast Steel, gate, globe, and check.

1.2 RELATED SECTIONS

.1 Section 23 05 01 - Installation of Pipework.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings.
  .2 ANSI/ASME B16.10, Face-to-Face and End-to-End Dimensions Valves.
  .3 ANSI/ASME B16.25, Buttwelding Ends.
  .4 ANSI/ASME B16.3, Valves - Flanged, Threaded and Welding End.
.2 American Petroleum Institute (API).
  .1 API 598, Valve Inspection and Testing.
.3 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A49, Specification for Heat-Treated Carbon Steel Joint Bars.
  .2 ASTM A193/A193M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
  .3 ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
  .4 ASTM A216/A216M, Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.
  .5 ASTM B85, Specification for Aluminum-Alloy Die Castings.
.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.
  .2 MSS SP-61, Pressure Testing of Steel Valves.

1.4 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data: submit WHMIS SDS - Safety Data Sheets.
  .1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .2 Submit data for valves specified this section.
  .3 Submit product data in accordance with Division 01 - General Requirements.
.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.5 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.6 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:
.2 Separate and recycle waste materials in accordance with Division 01 - General Requirements.

.3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.7 MAINTENANCE

.1 Extra Materials:
.2 Furnish following spare parts:
  .1 Valve seats: one for every 10 valves each size, minimum 1.
  .2 Discs: one for every 10 valves, each size, minimum 1.
  .3 Stem packing: one for every 10 valves, each size. Minimum 1.
  .4 Valve handles: 2 of each size.
  .5 Gaskets for flanges: one for every 10 flanged joints.

2 Products

2.1 MATERIAL

.1 Valves:
  .1 Except for specialty valves, to be of single manufacturer.
  .2 Valves to be individually tested.
.2 Requirements common to valves, unless specified otherwise:
  .1 Pressure-temperature ratings: to ANSI B16.34.
  .2 Inspections and tests: to API 598.
  .3 Pressure Testing: to MSS SP-61.
  .4 Flanged valves:
    .1 Face-to-face dimensions: to ANSI B16.10.
    .2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face.
  .5 Butt-weld valves:
    .1 End-to-end dimensions: to ANSI B16.10.
    .2 End dimensions: to ANSI B16.25 bored for standard pipe schedule.
  .6 Handwheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49.
  .7 Markings: to MSS SP-25.
  .8 Identification:
    .1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.
    .2 Body markings: manufacturer, size, primary service rating, material symbol.
  .9 CRN registration number required for all products.

2.2 GATE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, solid wedge disc, flanged ends, Class 150 or class 300:
  .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB, with full length disc guides designed to ensure correct re-assembly.
  .2 Body/bonnet joint: Flat face with corrugated metallic gasket.
  .3 Bonnet studs: to ASTM A193/A193M Type B7.
  .4 Bonnet nuts: to ASTM A194/A194M Type 2H.
  .5 Stuffing box: including non-galling two-piece ball jointed packing gland, with swing-type eye bolts and nuts.
  .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
  .7 Yoke sleeve: Ni-Resist, minimum melting point above 954 degrees C.
  .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
  .9 Disc: with disc stem ring to connect to stem, guided throughout its travel.
    .1 NPS 2 1/2 - 6: Solid corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.
    .2 NPS 8 and larger: Carbon steel faced with corrosion and heat resistant 13 chromium steel with minimum hardness of 350 HB.

.10 Seat ring: seamless carbon steel with hard-faced cobalt-chromium-tungsten alloy seating surface, slipped in, seal welded, ground to match disc.
.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for hand wheel nut, T-head disc-stem connection.
.12 Operator: see elsewhere this section.

2.3 GLOBE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, flanged ends, Class 150 or class 300:
.1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB.
.2 Body/bonnet joint: Flat face with corrugated metallic gasket.
.3 Bonnet studs: to ASTM A193/A193M Type B7.
.4 Bonnet nuts: to ASTM A194/A194M Type 2H.
.5 Stuffing box: including non-galling two-piece ball-jointed packing gland, with swing-type eye bolts and nuts.
.6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
.7 Yoke bushing: Ni-Resist, minimum melting point above 954 degrees C.
.8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
.9 Disc: Plug type with 15 degrees taper seat and bottom guide.
.10 Seat rings: with 1.6 mm thick cobalt-chromium-tungsten alloy facings with minimum hardness of 375 HB (cold), slipped in, seal welded, ground to match disc.
.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with bonnet bushing, long engagement with yoke bushing for accurate seating, accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.
.12 Operator: see elsewhere this section.

2.4 VALVE OPERATORS

.1 Handwheel: on all valves except as specified.
.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in Boiler Rooms.
.3 Hydraulic operators:

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.
.2 Position of bypass valve on main valves: Stem vertical on parallel position.
.3 Size of bypass valve:
.1 Main valve up to NPS 8: NPS 3/4.
.2 Main valve NPS 10 and over: NPS 1.
.4 Type of bypass valves:
.1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.
.2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.

2.6 CHECK VALVES

.1 NPS 2 1/2 and over, flanged ends, Class 150 or class 300: swing check.
.1 Body and multiple-bolted cap: cast steel to ASTM A216/A216M WCB.
.2 Cap studs: to ASTM A193/A193M Type B7.
.3 Cap nuts: to ASTM A194/A194M Type 2H.
.4 Body/cap joint: male-female face with corrugated metallic gasket.
.5 Disc: heat treated corrosion and heat resistant 13% chromium steel.
.6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.

.7 Hinge: ASTM A 216 WCB.
.8 Hinge pin: 410 Stainless Steel.

2.7 SILENT CHECK VALVES

.1 Construction:
.1 Body: Cast carbon steel to ASTM A216/A216M, Grade WCB, with integral seat.
.2 Pressure rating: Class 125, 250.
.3 Connections: Flanged ends.
.4 Double bronze disc with SS seat and stem. Renewable disc, seat, stem and spring. Spring rating must match system design for silent operation and installation.
.5 Stainless steel spring, heavy duty.
.6 Seat: regrindable.

2.8 ACCEPTABLE MATERIAL

.1 Crane, Jenkins, Newaman Hattersley, M.A. Stewart, Millwaukee (silent check valves).

3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.

3.2 COMMISSIONING

.1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Plug Valves - Lubricated plug valves, Eccentric plug valves.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
  .3 ANSI/ASME B16.11, Forged Fittings, Socket-Welding and Threaded.
  .4 ANSI/ASME B16.25, Buttwelding Ends.
  .5 ANSI/ASME B16, Valves - Flanged, Threaded and Welding End.
  .6 ANSI/ASME B16.10, Face to Face and End to End Dimensions of Valves.
.2 American Society for Testing and Materials International (ASTM).
  .1 ASTM A126-95, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
.3 Manufacturer's Standardization Society of the Valves and Fittings Industry Inc. (MSS).
  .1 MSS SP-78, Cast Iron Plug Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.
  .1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .2 Submit product data in accordance with Division 01 - General Requirements.
  .3 Submit data for valves specified this Section.
.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.5 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:
  .1 Separate and recycle waste materials in accordance with Division 01 - General Requirements.
  .2 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.6 MAINTENANCE

.1 Extra Materials:
.2 Furnish following spare parts:
  .1 Valve seats: one for every 10 valves each size, minimum 1.
  .2 Discs: one for every 10 valves, each size, minimum 1.
  .3 Stem packing: one for every 10 valves, each size, minimum 1.

.4 Valve handles: 2 of each size.
.5 Gaskets for flanges: one for every 10 flanged joints.

2 Products

2.1 MATERIAL

.1 Valves:
  .1 Except for specialty valves, to be of single manufacturer.
  .2 Products to have CRN registration number.

2.2 ECCENTRIC PLUG VALVES

.1 General:
  .1 Dead-tight shut-off on liquids and gases at pressure differentials up to 1.2 MPa in forward direction, 520 kPa in reverse direction.
.2 Up to NPS 2, screwed ends:
  .1 Body: cast iron to ASTM B209 Class B.
  .2 Plug:
    .1 NPS 1/2 and 3/4: bronze to ASTM B62.
    .2 NPS 1 to NPS 2: bronze to ASTM B62.
  .3 Bearings: permanently lubricated, bronze to ASTM B62 in upper and lower journals.
  .4 Seals: double-seal consisting of:
    .1 Plastic seat coating between plug and body.
    .2 Resilient seal moulded into groove in plug face.
    .3 Seal materials: BUNA Stem seals with HYCAR plug seals.
    .4 VITON stem seals with Fluorinated hydrocarbon plug seals.
    .5 Isobutene Isoprene stem seal with isobutene-isoprene plug seals.
  .5 End connections: screwed, or roll grooved.
  .6 Operators: lever.
.3 NPS 2 1/2 to NPS 4, flanged ends:
  .1 Body: cast iron to ASTM B209 Class B.
  .2 Plug: nickel-plated cast iron to ANSI.
  .3 Bearings: permanently lubricated, bronze to ASTM B62 in upper and lower journals.
  .4 Seals: double-seal consisting of:
    .1 Plastic seat coating between plug and body.
    .2 Resilient seal moulded into groove in plug face.
    .3 Seal materials: BUNA Stem seals with HYCAR plug seals.
    .4 VITON stem seals with Fluorinated hydrocarbon plug seals.
    .5 Isobutene Isoprene stem seal with isobutene-isoprene plug seals.
  .5 End connections: flanged to ANSI B16.1 roll grooved.
  .6 Operators: lever.

2.3 LUBRICATED PLUG VALVES

.1 Principle of operation:
  .1 Special sealing compound used to effect tight seal. When line pressure applied to valve in closed position, parallel plug forced against downstream side of valve. The metal-to-metal contact and sealing compound ensures leak-tight seal.
.2 Testing to specifications: MSS SP-78 for non-shock pressure at specified temperature.
.3 End connections:
  .1 NPS 1/2 to 2: screwed ends.
  .2 NPS 2 1/2 to 12: flanged ends.
.4 Valve:
  .1 Body: cast iron to ASTM A126 Class B semi-steel.
  .2 Pressure rating: NPS 1/2 to 12:
    .1 Screwed end valves: screwed to NPT standards.

.2 Flanged end valves: flanged to ANSI B16.1 Class 125, 125 psig @232 degrees C. Flanged valves NPS 2-8 face dimensions in accordance with ANSI B16.10 short pattern, making them interchangeable with Class 125 flanged cast iron gate valves.

.3 Hydrostatic tests: body 300 psig. Seat: 100 psig.

.3 Plug: cylindrical, with regular pattern port - 90 degrees from full open to fully closed, complete with PFTE thrust ring: 100% full port.

.4 Number of ports: as indicated.

.5 Ends: with hexagon shoulders, ends screwed to ANSI B1.20.1.

.6 Lubrication system, nickel-plated.

.7 Lubricant: to suit type, temperature and pressure of contained fluid.

.8 Provide sealing compound injection gun designed for use with pre-packed sealing compound cartridges and valve fitted with button head nipples and combination sealing screws.

.9 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leak proof operation, and corrosion preventing film. Lubricant receptacle to hold additional lubricant. Lubricant screw for lubrication. Check valve to prevent reverse flow of lubricant. O-rings between body and plug.

.5 Operator:

.1 Up to NPS 5: manual lever.

.2 NPS 6 - 8: CGA approved gear-operated handwheel.

.3 NPS 6 - 12: gear-operated handwheel with screwed bottom cover.

.4 NPS 14 - 24: gear-operated handwheel with fully enclosed gearing automatic - electrical.

.6 3-port and 4 port valves:

.1 To be supplied transflow pattern, to allow reduced flow through ports during rotation of plug from one position to another.

.2 Limit stops: to be provided.

.7 Accessories: lubricant gun.

3 Execution

3.1 INSTALLATION OF LUBRICATED PLUG VALVES

.1 Install with line pressure acting to hold plug against body ports which are to be cut-off from higher pressure.

3.2 COMMISSIONING OF LUBRICATED PLUG VALVES

.1 Determine the type of sealing compound for particular application.

.2 Open and close valve at least 3 times to ensure distribution of sealing compound evenly and to ensure tight shut-off.

.3 When operating valve, ease valve off body to ensure that plug is free to float.

.4 Determine frequency of re-lubrication during commissioning of remainder of system.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Butterfly Valves.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-, Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.1-, Cast Iron Pipe Flanges and Flanged Fittings.
  .3 ANSI/ASME B16.5-, Pipe Flanges and Flanged Fittings.
  .4 ANSI/ASME B16.11-, Forged Fittings, Socket-Welding and Threaded.
  .5 ANSI/ASME B16.25-, Buttwelding Ends.
  .6 ANSI/ASME B16.34-, Valves - Flanged, Threaded and Welding Ends.
.2 American National Standards Institute (ANSI)/American Petroleum Institute (API).
  .1 ANSI/API 609-, Lug- and Water-Type Butterfly Valves.
.3 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A126-, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .2 ASTM B62-, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B209M-, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS SP-67-, Butterfly Valves.

1.3 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.
  .1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .2 Submit product data in accordance with Division 01 - General Requirements.
  .3 Submit data for valves specified this section.
.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.5 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:
.2 Separate and recycle waste materials in accordance with Division 01 - General Requirements.
.3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

1.6 MAINTENANCE

.1 Extra Materials:
  .1 Furnish following spare parts:
    .1 Valve seats: one for every 10 valves each size, minimum 1.
    .2 Discs: one for every 10 valves, each size, minimum 1.

.3 Stem packing: one for every 10 valves, each size, minimum 1.
.4 Valve handles: 2 of each size.
.5 Gaskets for flanges: one for every 10 flanged joints.

1.7 APPROVED EQUIPMENT - KITZ, MAS

.1 Butterfly options:
  .1 Locking
  .2 Infinite positioning 3 way T-Assemblies
  .3 Automation packages pneumatic and electric
  .4 Modulating/Jog
  .5 On/off
  .6 Fail position - open or closed

2 Products

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 200 PSIG

.1 Except to specialty valves, to be of single manufacturer.
.2 To be suitable for dead-end service and bubble tight shut-off to 200 psi downstream flange removed.
.3 CRN registration number required for products.
.4 Sizes: Wafer or lug type: NPS 2 to 30.
.5 Pressure rating for tight shut-off at temperatures up to maximum for seat material.
  .1 NPS 2 - 12: 200 psig 1380 KPA.
  .2 NPS 14 - 48: 200 psig.
.6 Minimum seat temperature ratings to 135 degrees C.
.7 Application: on-off operation.
.8 Full lug body (threaded).
.9 Operators:
  .1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel. Standard coating: black lacquer.
  .2 NPS 8 - 30: Manual enclosed gear operator.
.10 Designed to comply with MSS SP-67 and API 609 NSF 61/372 Certified.
.11 Compatible with ANSI Class 125/Class 150 flanges.
.12 Construction:
  .1 Body ductile iron.
  .2 Disc: aluminum bronze.
  .3 Seat: EPDM molded or bonded 2" extended neck to allow for insulation.
  .4 Shaft: 416 stainless steel.
  .5 Taper pin: 316 SS.
  .6 Key: carbon steel or stainless.
  .7 O-Ring: Buna-N.
  .8 Bushings: Luberized bronze teflon.

2.2 BUTTERFLY VALVES - RESILIENT SEAT - 285 PSIG

.1 Sizes: Lug type: NPS 2 to 48.
.2 Pressure rating: 285 psig at 135 degrees C.
.3 Lug body: 150 ANSI bolt pattern.
.4 Full lug body (threaded).
.5 Application: for on-off service.
.6 Operators:

.1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel.
.2 NPS 8 - 24: Manual enclosed gear operator.
.3 Install parallel or perpendicular to pipeline.

.7 Designed to comply with MSS SP-67 and API 609.
.8 Compatible with ANSI B16.1 Class 125 (iron) and ANSI B16.5 Class 150 (steel) flanges.
.9 Construction:
.1 Body: ductile iron.
.2 Disc: aluminum bronze.
.3 Seat: EPDM.
.4 Refer to manufacturer's literature for additional materials.
.5 Shaft: NPS 2 - 12: 416 stainless steel, NPS 14 - 28: 316 stainless steel.
.6 Taper pin: 316 SS.
.7 Blowout proof stem.
.8 O-Ring: Buna-N.
.9 Bushings: teflon.
.10 Disc shall not be pinned to shaft.
.11 Bubble tight shutoff with downstream flanges removed, class 6 shutoff.

2.3 MOUNTING FLANGES

.1 Class 125 cast iron to ANSI B16.1 or Class 150 steel to B16.5 pipe flanges.

2.4 BUTTERFLY VALVES - 300 PSIG

.1 Sizes: Grooved ends: NPS 2 to 12.
.2 Pressure rating: 300 psig WOG 2068 KPA/300psi Rating NSF 372 Certified.
.3 Body: Ductile iron to ASTM A-536 with polypropylene coating grooved to AWWA C606 stainless steel stem.
.4 Disc: Ductile iron to ASTM A-536.
.5 Disc coating: EPDM, Encapsulated Disk.
.6 Fusion bonded epoxy coating in accordance with ANSI/AWWA C550.
.7 Body coating: Polyphenylene sulfide blend.
.8 Drive hub adapter and Operation Bracket: hot rolled steel, enamel coated.
.9 Upper bearing/lower trunnion seals: EPDM
.10 Upper bearing/lower trunnion: Navel brass or Bronze alloy.
.11 Bolts and washers: Cold rolled steel, zinc plated.
.12 Operator:
.1 NPS 2 to 3: two position manual handle
.2 NPS 4 to 6: Manual lever lock
.3 NPS 8 to 12: Manual gear operator with handwheel
.4 Handwheel with chain operator on valves installed more than 2400 mm above floor in boiler rooms and mechanical equipment rooms.

2.5 ELECTRIC ACTUATORS

.1 Operation: designed to provide precise quarter turn electric operation.
.1 Torque range: up to 1.130 N-m and speed ranges from 10 seconds to 30 seconds to move from fully open to fully closed.
.2 Gear train within actuator to provide smooth continuous rotary power stroke for accurate automatic valve positioning. Factory-set, field adjustable cam-actuated travel limit switches to provide precise control of shaft rotation.
.2 Construction:
.1 Castings: heavy duty industrial grade for rugged use.
.2 Actuators: continuous duty with high efficiency single phase reversing capacitor motor with thermal overload protection.

.3 Gears and pinions constructed from hardened steel.
.4 Gear train to be permanently lubricated.
.5 Mechanical brake to ensure that gear is locked in precise position.

.3 Electrical:
.1 Standard voltage: 120 VAC. 60 Hz.
.2 Control options: 4-20 Ma DC or 0-10 VDC.
.3 CSA approved.
.4 Electrical rating: NEMA IV.

3 Execution

3.1 PREPARATION

.1 Valve and mating flange preparation.
.1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
.2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
.3 Install butterfly valves with disc in almost closed position.
.4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

.1 Install in accordance with manufacturer's instructions.
.2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
.3 Verify suitability of valve for application by inspection of identification tag.
.4 Mount actuator on to valve prior to installation.
.5 Handle valve with care so as to prevent damage to disc and seat faces.
.6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.
.7 Ensure that valves are centred between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 ACTUATOR INSTALLATION

.1 Air hoses or electrical connections to be made by actuator manufacturer.
.2 Cycle valve operation from fully closed to fully open then back to fully closed.
.3 At same time, check travel stop settings for proper disc alignment.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 RELATED SECTIONS

.1 Section 03 30 00 - Cast in Place Concrete.
.2 Section 05 12 23 - Structural Steel for Buildings.
.3 Section 05 50 00 - Metal Fabrication.

1.3 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  .1 ANSI/ASME B31.1, Power Piping.
.2 American Society for Testing and Materials International (ASTM)
  .1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.
  .2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  .3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.
.3 Factory Mutual (FM)
.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).
.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  .1 MSS SP58, Pipe Hangers and Supports - Materials, Design and Manufacture.
  .2 ANSI/MSS SP69, Pipe Hangers and Supports - Selection and Application.
  .3 MSS SP89, Pipe Hangers and Supports - Fabrication and Installation Practices.
.6 Underwriter's Laboratories of Canada (ULC)

1.4 SYSTEM DESCRIPTION

.1 Design Requirements:
  .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
  .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
  .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
.2 Performance Requirements:
  .1 Design supports, platforms, cat walks, hangers, to withstand seismic events for locations as per the national building code.

1.5 SUBMITTALS

.1 Submittals: in accordance with Division 01 - General Requirements.
.2 Shop drawings: submit drawings stamped and signed for approval by Owner's representative.
.3 Submit shop drawings and product data for following items:
  .1 Bases, hangers and supports.

.2 Connections to equipment and structure.
.3 Structural assemblies.
.4 Quality Assurance Submittals: submit following in accordance with Division 01 - General Requirements.
.1 Certification by manufacturer: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturers installation instruction.
.1 Consultant will make available one (1) copy of systems suppliers installation instructions.
.4 Closeout Submittals:
.1 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.6 QUALITY ASSURANCE

.1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58 and MSS SP59.
.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:
.1 Pipe hangers and supports: galvanized, painted with zinc-rich paint after manufacture.
.2 Use electro-plating galvanizing process or hot dipped galvanized process.
.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
.2 Upper attachment structural: suspension from lower flange of I-Beam:
.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
.1 Rod: 9 mm UL listed, 13 mm FM approved.
.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed FM approved where required to MSS-SP58 and MSS-SP69.
.3 Upper attachment structural: suspension from upper flange of I-Beam:
.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed. FM approved where required to MSS SP69.
.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved where required.
.4 Upper attachment to concrete:
.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
.2 Concrete inserts: wedge shaped body with knockout protector plate, UL listed to FM approved where required to MSS SP69.
.5 Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies: MSS SP89.
.2 Steel brackets: MSS SP89.
.3 Sway braces for seismic restraint system: to MSS SP89.0

.6 Hanger rods: threaded rod material to MSS SP58:
.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP58:
.1 Attachments for steel piping: carbon steel galvanized.
.2 Attachments for copper piping: copper plated black steel.
.3 Use insulation shields for hot pipework.
.4 Oversize pipe hangers and supports for insulated pipes.

.8 Adjustable clevis: material to MSS SP69 UL listed, (FM approved where required) clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
.1 Ensure "U" has hole in bottom for riveting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
.1 Finishes for steel pipework: galvanized.
.2 Finishes for copper, glass, brass or aluminum pipework: black with farmed portion plastic coated or epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed, FM approved where required.
.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
.3 Bolts: to ASTM A307.
.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:
.1 64 kg/m3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:
.1 Curved plate 300 mm long, with edges turned up, welded-in center plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
.3 Provide upper and lower factory set travel stops.
.4 Provide load adjustment scale for field adjustments.
.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.
.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.9 PLATFORMS AND CATWALKS

.1 To Section 05 50 00 - Metal Fabrications.

2.10 HOUSE-KEEPING PADS

.1 For base mounted equipment: Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

2.11 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.
.2 Submit structural calculations with shop drawings.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:
  .1 manufacturer's instructions and recommendations.
.2 Vibration Control Devices:
  .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
.3 Clamps on riser piping:
  .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  .2 Bolt-tightening torques to be to industry standards.
  .3 Steel pipes: install below coupling or shear lugs welded to pipe.
  .4 Cast iron pipes: install below joint.
.4 Clevis plates:
  .1 Attach to concrete with four (4) minimum concrete inserts, one (1) at each corner.
.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
.6 Use approved constant support type hangers where:
  .1 Vertical movement of pipework is 13 mm or more.
  .2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:
  .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  .2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: to most stringent requirements of Canadian Plumbing Code.
.2 Fire protection: to applicable fire code.
.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
.4 Copper piping: up to NPS 1/2: every 1.5 m.
.5 Hyronic, steam, condensate, rigid and flexible roll grooved piped: in accordance with table below, but not less than one hanger at joints.
.6 Within 300 mm of each elbow.

Max Pipe Size: NPS	Max Spacing Steel	Max Spacing Copper
up to 1-1/4	2.1m	1.8m
1-1/2	2.7m	2.4m
2	3.0m	2.7m
2-1/2	3.6m	3.0m
3	3.6m	3.0m
3-1/2	3.9m	3.3m
4	4.2m	3.6m
5	4.8m	
6	5.1m	
8	5.7m	
10	6.6m	
12	6.9m	
Pipework greater than NPS 12: to MSS SP69		

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.
.2 Adjust hangers to equalize load.
.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members. Comprised of angle Iron or c-channel.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:
  .1 Ensure that rod is vertical under operating conditions.
  .2 Equalize loads.
.2 Adjustable clevis:
  .1 Tighten hanger load nut securely to ensure proper hanger performance.
  .2 Tighten upper nut after adjustment.
.3 C-clamps:
  .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Vibration isolation materials and components, seismic control measures and their installation.

1.2 RELATED SECTIONS

- .1 Section 03 30 33 - Cast in Place Concrete.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.3 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Safety Data Sheets (SDS).

.2 National Fire Protection Association (NFPA)
- .1 NFPA 13, Standard for the Installation of Sprinkler Systems.

.3 National Research Council
- .1 National Building Code of Canada 2020 (NBC 2020).

1.4 SUBMITTALS

.1 Submittals: in accordance with Division 01 - General Requirements.
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Division 01 - General Requirements.

.2 Submit shop drawings in accordance with Division 01 - General Requirements.
- .1 Provide separate shop drawings for each isolated system complete with performance and product data.
- .2 Shop drawings; submit drawings stamped and signed for approval by Consultant.
- .3 Provide detailed drawings of seismic control measures for equipment and piping.

.3 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.
  - .1 Consultant will make available 1 copy of systems supplier's installation instructions
- .3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.5 ADDITIONAL REQUIREMENTS

.1 The Contractor and the vibration isolation manufacturer or his regularly designated and factory authorized representative shall perform the following tasks in addition to the supply and installation of isolation equipment.
- .1 Obtain from the Architect the approved manufacturer's name, model number, and other necessary identifying data for each item of mechanical and electrical equipment to be resiliently mounted. Coordinate all resilient mounting systems with the exact equipment to be furnished in regard to physical size, isolator locations, weight, rotating speed, etc. Direct contact and cooperation between the vibration isolation device fabricator and the equipment manufacturer will be required.

.2 Obtain all necessary date in regard to piping systems which are to be resiliency supported so that proper isolators can be selected. Select piping system isolators for proper coordination with the physical arrangement of pipe lines and with the physical characteristics of the building.

.3 Submit shop drawings as required by other portions of this specification. These drawings shall include specification information as follows:

.1 Manufacturer's model number for each isolator, the machine or pipeline to which it is to be applied, and the number of isolators to be furnished for each machine or pipeline.

.2 For steel spring mounts or hangers - free height, deflected height, solid height, isolator loading, and diameter of spring coil.

.3 For elastomer or glass fiber isolators - free height, deflected height, and isolator loading.

.4 Dimensional and weight data for concrete inertia bases, steel and rail bases, and details of isolator attachment.

.4 Provide on-the-job supervision as required during installation of resiliently mounted equipment and piping to assure that all vibration isolators are installed in strict accordance with normally accepted practices for critical environments.

.5 Replace at no extra cost to the Owner and isolators which do not produce the required deflection, are improperly loaded above or below their correct operating height, or which in any way do not produce the required isolation.

.6 Cooperate with all other Contractors engaged in this project so that the installation of vibration isolation devices will proceed in a manner that is in the best interests of the Owner.

.7 Notify the Architect of any project conditions which affect vibration isolation system installation or performance and which are found to be different from conditions indicated by the drawings or described by the specifications. Should vibration isolation system installation proceed without such notifications any remedial work required to achieve proper isolator performance shall be accomplished by the Contractor at no additional cost to the Owner.

.8 Be alert for possible "short-circuiting" of vibration isolation systems by piping supports, electrical connections, temperature control connections, drain lines, building construction, etc., and notify the involved contractor as to these problems or potential problems. Where such situations cannot be easily resolved, notify the Architect so that preventive or remedial action can take place on a timely basis. Any remedial measures required shall be undertaken by the contractor responsible at no additional cost to the Owner.

1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Division 01 - General Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Division 01 - General Requirements.

2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 9mm minimum thick; 50 durometer; maximum loading 350 kPa.
.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
.3 Type EP3 - neoprene-steel-neoprene; 9mm minimum thick neoprene bonded to 1.71mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
.4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.4 SPRINGS

.1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with leveling devices.
.2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
.3 Cadmium plate for outdoor installations, 100% relative humidity.
.4 Colour code springs.

2.5 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
.2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
.3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; leveling bolt for rigidly mounting to equipment.
.4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.
.6 Acceptable material: Korfund, Masdom, Vibron, Vibro Acoustics, Mason

2.6 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
.2 Type H1 - neoprene - in-shear, molded with rod isolation bushing which passes through hanger box.
.3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.
.4 Type H3 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.
.5 Acceptable material: Korfund, Masdom, Vibron, Vibro Acoustics, Mason.

2.7 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.8 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.
.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.9 STRUCTURAL BASES

.1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.
.2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.
.3 Bases to clear housekeeping pads by 25 mm minimum.
.4 Acceptable material: Korfund, Masdom, Vibron, Vibro Acoustics, Mason.

2.10 ROOF CURB ISOLATION RAILS

.1 General: complete factory assembled without need for sub-base.
.2 Lower member: continuous rectangular steel tube or extruded aluminum channel.
.3 Upper member: continuous rectangular steel tube or extruded aluminum channel to provide continuous support for equipment, complete with all-directional neoprene snubber bushings 6 mm thick to resist wind and seismic forces.
.4 Springs: steel, adjustable, removable, selected for 50 mm maximum static deflection plus 50% additional travel to solid, cadmium plated, sized and positioned to ensure uniform deflection.
.5 High frequency isolation: 6 mm minimum thick continuous gasket on top and bottom of complete assembly, or pads on top and bottom of each spring. Material: closed cell neoprene.
.6 Weatherproofing: continuous flexible counterflashing to curb and providing access to springs. Material: aluminum or neoprene.
.7 Hardware: cadmium plated or galvanized.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.
.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
  .1 Up to NPS 4: first 3 points of support. NPS 5 to NPS 8: first four points of support. NPS 10 and over: first six points of support.
  .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
.4 Where isolation is bolted to floor use vibration isolation rubber washers.
.5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
  .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
    .1 Manufacturer's Field Services: consisting of product use recommendations and site visits for inspection of product installation in accordance with manufacturer's instructions.
    .2 Submit reports to Consultant within 3 days of manufacturer representative's final review.
  .2 Make adjustments and corrections in accordance with written report.
.2 Inspection and Certification:
  .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  .2 Take vibration measurements for equipment as indicated.
  .3 Provide Consultant with notice 24 h in advance of commencement of tests.
  .4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
  .5 Submit complete report of test results including sound curves.

3.4 CLEANING

.1 Proceed in accordance with Division 01 - General Requirements.
.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.2 RELATED SECTIONS

.1 Section 09 91 00 - Painting.

1.3 REFERENCES

.1 Canadian Gas Association (CGA)
  .1 CSA/CGA B149.1-05, Natural Gas and Propane Installation Code.
  .2 CSA 7396.1 Medical Gas Pipeline Systems - Part 1: Pipelines for Medical Gases and Vacuum.
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
  .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
.3 National Fire Protection Association (NFPA)
  .1 NFPA 13-2002, Standard for the Installation of Sprinkler Systems.
  .2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose Systems.

1.4 SUBMITTALS

.1 Product Data:
  .1 Submittals: in accordance with Division 01 - General Requirements.
  .2 Product data to include paint colour chips, other products specified in this section.
  .3 Samples:
    .1 Submit samples in accordance with Division 01 - General Requirements.
    .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.
.2 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
  .1 Deliver, store and handle in accordance with Division 01 - General Requirements.
  .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.2 Waste Management and Disposal:
  .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Division 01 - General Requirements.
  .2 Dispose of unused paint material at official hazardous material collections site approved by Owner's Representative.
  .3 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
.2 Lettering and numbers raised or recessed.
.3 Information to include, as appropriate:
  .1 Equipment: manufacturer's name, model, size, serial number, capacity.
  .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:
  .1 Hazardous: red letters, white background.
  .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
.2 Construction:
  .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
.3 Sizes:
  .1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 100	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

  .2 Use maximum of 25 letters/numbers per line.
.4 Locations:
  .1 Terminal cabinets, control panels: use #5.
  .2 Equipment in Mechanical Rooms: use #9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.
.2 Where existing identification system does not cover for new work, use identification system specified this section.
.3 Before starting work, obtain written approval of identification system from Consultant.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:
  .1 Natural gas: to CSA/CGA B149.1.
  .2 Propane gas: to CSA/CGA B149.1.
  .3 Sprinklers: to NFPA 13.
  .4 Standpipe and hose systems: to NFPA 14.
  .5 Medical Gas: to CAN/CSA Z 7396.1.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive plastic-coated cloth with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Owner's Representative.

Background colour:	**Legend, arrows:**
Yellow	BLACK
Green	WHITE
Red	WHITE

.2 Colours for legends, arrows: to following table:

Contents	**Background colour marking**	**Legend**
City water	Green	CITY WATER
Ground-source geothermal loop supply	Green	GEO. WTR. SUPPLY
Ground-source geothermal loop return	Green	GEO. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Dom. cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

.3 Background colour marking and legends for piping systems:

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stenciled letters and directional arrows 150 mm long x 50 mm high.
.2 Colours: back, or coordinated with base colour to ensure strong contrast.
.3 Identify Systems: eg Supply AHU-1, Exhaust EF-1

2.7 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.
.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
.2 Inscriptions to include function and (where appropriate) fail-safe position, component ID name.

2.9 LANGUAGE

.1 Identification in English.
.2 Use one nameplate and label for each language.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

.1 Provide identification only after painting specified Section 09 91 23 - Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
.2 Provide ULC and CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations:
  .1 In conspicuous location to facilitate easy reading and identification from operating floor.
.2 Standoffs:
  .1 Provide for nameplates on hot and/or insulated surfaces.
.3 Protection:
  .1 Do not paint, insulate or cover in any way.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
.2 Adjacent to each change in direction.
.3 At least once in each small room through which piping or ductwork passes.
.4 On both sides of visual obstruction or where run is difficult to follow.
.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
.7 At beginning and end points of each run and at each piece of equipment in run.
.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
.9 Identification easily and accurately readable from usual operating areas and from access points.
.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Consultant. Provide one copy (reduced in size if required) in each operating and maintenance manual.
.3 Number valves in each system consecutively.

3.7 CLEANING

.1 Proceed in accordance with Division 01 - General Requirements.
.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Consultant within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience. TAB Contractor shall have a minimum of five (5) years experience to AABC, NBC, NEBB or SMACNA

.3 TAB: performed in accordance with the requirements of Standard under which TAB Firm's qualifications are approved:

- .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.
- .2 National Balancing Council (NBC) Certified Air Balancing Specifications and Certified Hydronic Balancing Specifications.
- .3 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

- .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
- .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started confirm in writing to Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
.2 Review specified standards and report to Consultant in writing proposed procedures which vary from standard.
.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.9 START OF TAB

.1 Notify Consultant seven (7) days prior to start of TAB.
.2 Start TAB when building is essentially completed, including:
  .1 Installation of ceilings, doors, windows, other construction affecting TAB.
  .2 Application of weatherstripping, sealing, and caulking.
  .3 Pressure, leakage, other tests specified elsewhere Division 23.
  .4 Provisions for TAB installed and operational.
.3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
  .1 Proper thermal overload protection in place for electrical equipment.
  .2 Air systems:
    .1 Filters in place, clean.
    .2 Duct systems clean.
    .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
    .4 Correct fan rotation.
    .5 Fire, smoke, volume control dampers installed and open.
    .6 Coil fins combed, clean.
    .7 Access doors, installed, closed.
    .8 Outlets installed, volume control dampers open.
  .3 Liquid Systems:
    .1 Flushed, filled, vented.
    .2 Correct pump rotation.
    .3 Strainers in place, baskets clean.
    .4 Isolation and balancing valves installed and open.
    .5 Calibrated balancing valve installed at factory settings.
    .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 Laboratory and hospital HVAC Systems: plus 10%, minus 0%.
.2 Other HVAC Systems: plus 5%, minus 5%.
.3 Hydronic Systems: plus or minus 10%.
.4 Refrigeration Systems: plus or minus 10%

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Consultant list of instruments used together with serial numbers.
.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:
.1 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
.1 Details of instruments used.
.2 Details of TAB procedures employed.
.3 Calculations procedures.
.4 Summaries.

1.15 TAB REPORT

.1 Format in accordance with referenced standard.
.2 TAB report to show results in SI units and to include:
.1 Project record drawings.
.2 System schematics.
.3 Submit three (3) copies of TAB Report to Consultant for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Consultant.
.2 Provide personnel and instrumentation to verify up to 30 % of reported results.
.3 Number and location of verified results as directed by Consultant.
.4 Pay costs to repeat TAB as required to satisfaction of Consultant.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Consultant, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Consultant.

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section.
.2 Do TAB of systems, equipment, components, controls specified in other Divisions.

.3 Qualifications: personnel performing to be qualified to Standards of AABC, NBC or NEBB.
.4 Quality assurance: perform TAB under direction of supervisor qualified to Standards of AABC, NBC, or NEBB.
.5 Measurements: to include as appropriate for systems, equipment, components, controls:
  .1 Air velocity
  .2 Static pressure
  .3 Flow rate
  .4 Pressure drop (or loss)
  .5 Temperatures (dry bulb, wet bulb, dewpoint)
  .6 Duct cross-sectional area
  .7 RPM
  .8 Electrical power
  .9 Voltage
  .10 Noise
  .11 Vibration
  .12 Amperage and volts for each stage of electric heating coils.
.6 Locations of equipment measurements: to include but not be limited to, following as appropriate:
  .1 Inlet and outlet of dampers
  .2 Filter
  .3 Coil
  .4 Humidifier
  .5 Fan
  .6 Other equipment causing changes in conditions.
  .7 Controllers.
  .8 Controlled device.
.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 HYDRONIC SYSTEMS

.1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.
.2 Standard: TAB to be to most stringent of TAB standards of AABC, NBC or NEBB.
.3 Do TAB of systems, equipment, components, controls specified in other Divisions.
.4 Qualifications: personnel performing TAB to be qualified to standards of AABC, NBC or NEBB.
.5 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC, NBC or NEBB.
.6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls:
  .1 Flow rate
  .2 Static pressure
  .3 Pressure drop (or loss)
  .4 Temperature
  .5 Specific gravity
  .6 Density
  .7 RPM
  .8 Electrical power
  .9 Voltage
  .10 Noise
  .11 Vibration
.7 Locations of equipment measurement: to include, but not limited to, following as appropriate:
  .1 Inlet and outlet of heat exchangers (primary and secondary sides)
  .2 Boiler

.3 Chiller
.4 Coil
.5 Humidifier
.6 Cooling tower
.7 Condenser
.8 Pump
.9 PRV
.10 Control valve
.11 Other equipment causing changes in conditions
.12 At controllers
.13 Controlled device

.8 Locations of systems measurements to include, but not limited to, following as appropriate: supply and return of primary and secondary loops (main, main branch, branch, sub-branch) of all hydronic systems, inlet connection of make-up water.

1.21 DOMESTIC WATER SYSTEMS

.1 Meet requirements as specified for hydronic systems.
.2 Locations of equipment measurements: to include, but not limited to, following as appropriate: inlet and outlet heaters, tank, pump, circulator, at controllers, controlled device.
.3 Locations of systems measurements to include, but not limited to, following as appropriate: main, main branch, branch, sub-branch.

1.22 OTHER SYSTEMS

.1 Plumbing systems:
.1 Standard: National Plumbing Code.
.2 TAB procedures:
.1 Flush valves: adjust to suit project pressure conditions.
.2 Pressure booster systems: test for capacity and pressures under all conditions and at all times.
.3 Controlled flow roof drain systems: adjust weirs to suit actual roof conditions, slopes, areas drained.
.4 Pumped sanitary and storm water systems: test for proper operation at all possible flow rates.
.5 Pressure reducing station.
.2 Wet pipe sprinkler systems:
.1 Standard: NFPA.
.2 TAB procedures: Refer to NFPA 13 Sprinkler System.
.3 Chemical treatment systems:
.1 Standard: Section 23 25 00 - HVAC Water Treatment Systems.
.2 TAB procedures: refer to Section 23 25 00 - HVAC Water Treatment Systems.

1.23 POST-OCCUPANCY TAB

.1 Measure DBT, WBT (or %RH), air velocity, air flow patterns, NC levels, in occupied zone of areas designated by Owner's Representative.
.2 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 3 months of termination of Warranty Period.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Safety Data Sheets (SDS).
.2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
  .1 SMACNA HVAC Air Duct Leakage Test Manual.

1.3 SUBMITTALS

.1 Make submittals in accordance with Division 01 - General Requirements.
.2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
  .1 Submit proposed report form and test report format to Consultant for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Consultant.
  .2 Prepare report of results and submit to Consultant within 24 hours of completion of tests. Include:
    .1 Schematic of entire system.
    .2 Schematic of section under test showing test site.
    .3 Required and achieved static pressures.
    .4 Orifice differential pressure at test sites.
    .5 Permissible and actual leakage flow rate (L/s) for test sites.
    .6 Witnessed certification of results.
  .3 Include test reports in final TAB report.
  .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .5 Instructions: submit manufacturer's installation instructions.
  .6 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

2 Products

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:
  .1 Fan capable of producing required static pressure.
  .2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.
  .3 Flow measuring instrument compatible with the orifice plate.
  .4 Calibration curves for orifice plates used.
  .5 Flexible duct for connecting to ductwork under test.
  .6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.
.3 Submit details of test instruments to be used to Consultant at least three months before anticipated start date.
.4 Test instruments: calibrated and certificate of calibration deposited with Consultant no more than 28 days before start of tests.
.5 Re-calibrated every six months thereafter.

2.2 EQUIPMENT LEAKAGE TOLERANCES

.1 Equipment and System Components such as VAV Boxes, Duct Heating Leakage: 2%

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.
.2 Section of duct to be tested to include:
  .1 Fittings, branch ducts, tap-ins.
.3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.
.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.
.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

.1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.
.2 Leakage tests on following systems not to exceed specified leakage rates.
  .1 Small duct systems up to 250 Pa: leakage 2%.
  .2 VAV box and duct on downstream side of VAV box: leakage 2%.
  .3 Large low pressure duct systems up to 500 Pa: leakage 2%.
  .4 HP duct systems up to 1000 Pa pressure classification, including upstream side of VAV boxes: leakage 1%.
.3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TIMING OF TESTING

.1 Test ducts before installation of insulation or other forms of concealment.
.2 Test after seals have cured.
.3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

3.5 EXCLUSIONS

.1 Flexible connections to VAV boxes.

3.6 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.
  .1 Have manufacturer of products, supplied under this Section, review Work involved in the 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 Schedule site visits, to review Work, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately, to the Consultant.

.2 Performance Verification:

.1 Consultant to witness tests and to verify reported results.

.2 To be certified by same TAB agency approved by Consultant to undertake TAB on this project.

3.7 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ANSI/ASHRAE/IESNA 90.1-, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)
- .1 ASTM B209M-, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
- .2 ASTM C335-, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M-, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C547-, Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C553-, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612-, Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795-, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
- .9 ASTM C921-, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.3 Canadian General Standards Board (CGSB)
- .1 CGSB 51-GP-52Ma-, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).

.5 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S102-, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701-, Thermal Insulation Polyotrene, Boards and Pipe Covering.

.6 National Research Council
- .1 National Energy Code of Canada 2020 (NECC 2020)

1.3 DEFINITIONS

.1 For purposes of this section:
- .1 "CONCEALED" - means any work which is installed in suspended ceilings (accessible or non-accessible), attics and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - means any work which is not concealed in walls, shafts, or above accessible or non-accessible ceilings. Work behind doors, in closets, in cupboards, or under counters is considered exposed.
- .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:
- .1 CRD: Commercial Round Ductwork,
- .2 CRF: Commercial Rectangular Finish,
- .3 CEF: Commercial Rigid Insulation External Application.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.5 SAMPLES

.1 Submit samples in accordance with Division 01 - General Requirements.
.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.6 MANUFACTURERS' INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Division 01 - General Requirements.
.2 Installation instructions to include procedures used, and installation standards achieved.

1.7 QUALIFICATIONS

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to TIAC standards.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
.2 Protect from weather and construction traffic.
.3 Protect against damage from any source.
.4 Store at temperatures and conditions recommended by manufacturer.

1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - General Requirements.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
.4 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
.5 Divert unused adhesive material from landfill to official hazardous material collections site approved by Consultant.
.6 Do not dispose of unused adhesive materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:
  .1 Maximum flame spread rating: 25.
  .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
  .1 Mineral fibre: to ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:
  .1 220 gm/m2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
.2 Lagging adhesive: Compatible with insulation.
.3 Aluminum:
  .1 To ASTM B209 with moisture barrier as per attached Ductwork Insulation Schedule.
  .2 Thickness: 0.40 mm sheet.
  .3 Finish: Smooth.
  .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
    .1 Stainless steel:
  .5 Type: 304.
  .6 Thickness: 0.25 mm sheet.
  .7 Finish: Smooth.
  .8 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
.4 Self-adhesive weather barrier membranes shall be considered an alternate jacketing on all exterior ductwork, except high temperature ducts (i.e. grease exhaust ducts). Any exterior ductwork with this alternate shall be installed with 0% leakage.
  .1 Acceptable material: Bakor Foilskin.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:
  .1 Water based, fire retardant type, compatible with insulation.
.2 Indoor Vapour Retarder Finish:
  .1 Vinyl emulsion type acrylic, compatible with insulation.
.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
.4 ULC Listed Canvas Jacket:
  .1 220 gm/m2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
.5 Outdoor Vapour Retarder Mastic:
  .1 Vinyl emulsion type acrylic, compatible with insulation.
  .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m2.
.6 Tape: self-adhesive, aluminum, reinforced, 75 mm wide minimum.
.7 Contact adhesive: quick-setting
.8 Canvas adhesive: washable.
.9 Tie wire: 1.5 mm stainless steel.
.10 Banding: 12 mm wide, 0.5 mm thick stainless steel.
.11 Facing: 25 mm galvanized steel hexagonal wire mesh stitched on one face of insulation.
.12 Fasteners: 4 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems complete, witnessed and certified.
.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.
.2 Apply materials in accordance with manufacturers instructions and as indicated.
.3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Hangers, supports to be outside vapour retarder jacket.
.5 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
.6 Fasteners: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.

3.3 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thickness: Conform to following Table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts (exposed)	C-1	yes	50
Round cold and dual temperature supply air ducts (concealed)	C-2	yes	50
Rectangular warm air ducts (exposed)	C-1	no	25
Round warm air ducts (exposed)	C-1	no	25
Rectangular cold and dual temperature supply air ducts (concealed)	C-2	yes	50
Round cold and dual temperature supply air ducts (exposed)	C-1	yes	50
Rectangular warm air ducts (concealed)	C-2	no	25
Round warm air ducts (concealed)	C-2	no	25
Outside air ducts to mixing plenum	C-1	yes	50
Mixing Plenums	C-1	yes	25
Exhaust duct between dampers and louvers	C-1	no	50
Rectangular ducts outside	C-1	special	50
Round ducts outside	C-1	special	50
Acoustically lined ducts	See Section 23 33 53 - Duct Liners		

.1 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

.2 Finishes: Conform to following table:

	TIAC Code Rectangular	Round
Indoor, concealed	None	None
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
.2 Section 23 05 52 - Mechanical Identification.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  .1 ANSI/ASHRAE/IESNA 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.
.2 American Society for Testing and Materials (ASTM International)
  .1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
  .2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  .4 ASTM C449/C449M, Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  .5 ASTM C533, Specification for Calcium Silicate Block and Pipe Thermal Insulation.
  .6 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
  .7 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  .8 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.
  .9 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  .10 ASTM C921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
.3 Canadian General Standards Board (CGSB)
  .1 CGSB 51-GP-52Ma, Vapor Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  .2 CGSB 51-GP-53M, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
.4 Thermal Insulation Association of Canada (TIAC)
  .1 National Insulation Standards.
.5 Underwriters Laboratories of Canada (ULC)
  .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
.6 National Energy Code of Canada for Buildings (NECB).

1.3 PRODUCT DATA

.1 Submit Product Data in accordance with Division 01 - General Requirements.

1.4 SAMPLES

.1 Submit samples in accordance with Division 01 - General Requirements.
.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Division 01 - General Requirements.

.2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.6 QUALIFICATIONS

.1 Installer to be specialist in performing work of this section, and have at least three (3) years successful experience in this size and type of project, qualified to standards of TIAC.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
.2 Protect from weather and construction traffic.
.3 Protect against damage from any source.
.4 Store at temperatures and conditions recommended by manufacturer.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - General Requirements.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
.4 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
.5 Divert unused adhesive materials from landfill to official hazardous material collections site approved by Consultant.
.6 Do not dispose of unused adhesive materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:
  .1 Maximum flame spread rating: 25.
  .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: includes glass fibre, rock wool, slag wool.
.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
.3 TIAC Code A-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket.
  .1 Mineral fibre: ASTM C547.
  .2 Maximum "k" factor: ASTM C547.
.4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
  .1 Mineral fibre: ASTM C547.
  .2 Jacket: to CGSB 1-GP-52Ma.
  .3 Maximum "k" factor: ASTM C547.
.5 TIAC Code C-1: Rigid mineral fibre board, unfaced.
  .1 Mineral fibre: ASTM C612.
  .2 Maximum "k" factor: ASTM C612.
.6 TIAC Code C-4: Rigid mineral fibre board faced with factory applied vapour retarder jacket.
  .1 Mineral fibre: ASTM C612.
  .2 Jacket: to CGSB51-GP-52Ma.
  .3 Maximum "k" factor: ASTM C612.
.7 TIAC Code C-2: Mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: ASTM C553.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor: ASTM C553.

.8 TIAC Code A.6: Flexible unicellular tubular elastomer.
.1 Insulation: with vapour retarder jacket.
.2 Jacket: to CGSB 51-GP-52Ma.
.3 Maximum "k" factor.
.4 Certified by manufacturer free of potential stress corrosion cracking corrodants.

.9 TIAC Code A-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
.1 Insulation: ASTM C533.
.2 Maximum "k" factor: ASTM C533.
.3 Design to permit periodic removal and re-installation.

2.3 CEMENT

.1 Thermal insulating and finish
.1 To: ASTM C449/C449M.
.2 Hydraulic setting on mineral wool, to ASTM C449.

2.4 JACKETS

.1 Polyvinyl Chloride (PVC):
.1 One-piece moulded type and sheet to CGSB 51-GP-53M with pre-formed shapes as required.
.2 Colours: to match adjacent finish paint.
.3 Minimum service temperatures: -20°C.
.4 Maximum service temperature: 65°C.
.5 Moisture vapour transmission: 0.02 perm.
.6 Thickness: 0.56 mm.
.7 Fastenings:
.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
.2 Tacks.
.3 Pressure sensitive vinyl tape of matching colour.
.8 Special requirements:
.1 Indoor: Flame spread rating 25, smoke developed 50.
.2 Outdoor: UV rated material at least 0.5 mm thick.
.9 Covering adhesive: Compatible with insulation.

.2 ABS Plastic:
.1 One-piece moulded type and sheet with pre-formed shapes as required.
.2 Colours: to match adjacent finish paint.
.3 Minimum service temperatures: -40°C.
.4 Maximum service temperature: 82°C.
.5 Moisture vapour transmission: 0.012 perm.
.6 Thickness: 0.75 mm.
.7 Fastenings:
.1 Solvent weld adhesive compatible with insulation to seal laps and joints
.2 Tacks.
.3 Pressure sensitive vinyl tape of matching colour.
.8 Locations:
.1 For outdoor use ONLY.

.3 Canvas:
.1 220 gm/m2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
.2 Lagging adhesive: Compatible with insulation.

.4 Aluminum:

.1 To ASTM B209.
.2 Thickness: 0.50 mm sheet.
.3 Finish: Smooth.
.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

.5 Stainless steel:
.1 Type: 304 or 316.
.2 Thickness: 0.25 mm.
.3 Finish: Smooth.
.4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.5 REMOVABLE INSULATION COVERS

.1 General:
.1 All Covers shall be sewn, stapled or "hog-ringed" covers shall not be acceptable.
.2 Covers shall conform to the configuration of the items being insulated.
.3 Covers shall include openings for all protrusions such as pipes, packing glands on valves and expansion joints, hangers, supports, instrument lines, and other appurtenances.
.4 Covers shall be designed so that no force bending or folding of the cover is necessary for installation.
.5 Minimum 50 mm wide flaps at terminal ends are to be provided to overlap adjacent covers to ensure a good heat seal.
.6 Parting seems shall be at the installed low points (gravitational bottom) of the cover to allow drainage without the use of weep tubes or grommets.
.7 Valve bonnets are to be covered, but packing glands shall remain exposed.
.8 Valve covers are to be designed such that the bonnet section is sewn to the body section. For larger valves, the cover may be fabricated in two sections, each section containing one half of the valve body bonnet.
.9 Covers with a weight of 18.1 Kg or less are to be fabricated in one piece.
.10 Covers with a weight of more than 18.1 Kg are to be fabricated in more than one piece.

.2 Insulation Core:
.1 The insulation core shall be fabricated in one piece, wherever possible.
.2 To prevent insulation settlement, the insulation core shall be secured within the jacket through the weather barrier (outer jacketing), the insulation, and the liner (inner jacketing).
.3 Insulating cores with more than one piece shall have staggered joints to prevent hot spots and heat loss. The joint edges shall be butted together and extra securement provided at those edges.
.4 Insulation core shall be comprised of 50 mm thick fiberglass insulation of non-combustible wool with resilient inorganic glass fibers bonded with a thermosetting resin. Insulation density to be 38 Kg/m3. Insulation thermal conductivity to be 0.044W/m. deg C at a mean temperature of 100 deg C.

.3 Jacket:
.1 The jacket shall be fabricated in one piece, wherever possible.
.2 Gusset walls shall be required for covers with core insulation thickness in excess of 25 mm.
.3 All seams, except the final closing seam, shall be inside seams. The jackets are to be sewn inside out, then turned correct side out before inserting the insulation core. The

final closing seam shall be sewn on the exterior of the jacket. Seams shall be sewn with Teflon coated fiberglass thread or Kevlar coated stainless steel thread.

.4 Machine stitching shall be used for all sewing. Sewing shall be 6-8 stitches per centimeter.

.5 Draw cords are to be placed along the outer edge of the flap and the outer edge of the flap then rolled back inside and double stitched.

.6 Draw cords are to be of sufficient length to allow 150 mm of cords to protrude from each side of the flap.

.7 The inner and outer jacket shall be comprised of a fiberglass fabric impregnated with silicone rubber. The silicone rubber shall be flame retardant and suitable for high temperature usage. Outer jacket density shall be 595 gms/m2.

.4 Securement devices:

.1 The securement belts and D-ring belts shall be of the same material as the weather barrier (exterior jacket).

.2 The belts shall be placed 50 mm back from the parting seams and on 150 mm centers.

.3 Fire retardant Velcro shall be used to fasten the securement belt to the weather barrier after the belt passed through the Stainless Steel D-rings.

.5 Identification tags:

.1 Each cover shall be identified by a permanently attached stainless steel tag.

.2 An identification legend shall be mechanically embossed into the tag.

.3 The tags shall be located in the same areas on similar type covers.

.4 Should a cover require more than one piece for its construction, each piece to be identified and numbered (i.e. 1 or 3)

.5 Each tag shall include at least the following information, but may also include any pertinent information required by the end user.

.1 Type of item being covered.

.2 Location of item.

.3 Recording and tracking information.

.6 Warranty:

.1 Provide a 5-year product Warranty

.7 Acceptable material:

.1 Advanced Industrial Systems Inc., Thermo Help Canada Inc., Advanced Thermal Corp., Island Thermal Innovations.

2.6 INSULATION SECUREMENTS

.1 Tape: Self-adhesive, aluminum, plain, 50 mm wide minimum.

.2 Contact adhesive: Quick setting.

.3 Canvas adhesive: Washable.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

.6 Facing: 25 mm galvanized steel hexagonal wire mesh on one face of insulation.

.7 Fasteners: 2 mm diameter pins with 35 mm diameter clips. Length of pin to suit thickness of insulation.

2.7 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.8 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.9 OUTDOOR VAPOUR RETARDER MASTIC

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m2.

3 Execution

3.1 PRE- INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.
.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards
  .1 Hot equipment: To TIAC code 1503-H.
  .2 Cold equipment: to TIAC code 1503-C or 1503-CA.
.2 Elastomeric Insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.
.3 Provide vapour retarder as recommended by manufacturer.
.4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.
.5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  .1 Hangers, supports outside vapour retarder jacket.
.7 Supports, Hangers:
  .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 EQUIPMENT INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
.2 Hot Equipment:
  .1 TIAC code A-1 or C-1 mechanical fastenings or wire or bands and 13 cement reinforced with one layer of reinforcing mesh.
  .2 TIAC code A-2 with 25 mm air gap, mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.
  .3 TIAC code C-2 unfaced with wire and 13 mm cement precede by one layer of reinforcing mesh.
  .4 Thicknesses:
    .1 Domestic hot water storage tanks: 50mm.
    .2 Air Separators: 50mm.
    .3 Heat exchangers: 50mm (shell tube and plate exchangers)
    .4 Steam condensate receivers: 50mm
    .5 Dearator-feedwater heaters: 50mm
    .6 Expansion tanks: 50mm
    .7 Hot water buffer tanks: 50mm.
.3 Breechings, engine exhausts and mufflers:
  .1 TIAC code A-2 with 25 mm air gap, mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.
.4 Cold equipment:
  .1 TIAC A-3 or C-4 with mechanical fastenings, wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.
  .2 TIAC C-2 faced with vapour retardant jacket with wire or bands and 13mm cement preceded by one layer of reinforcing mesh.
  .3 TIAC A-6 or C-4 with mechanical fastenings, wire, bands or adhesive.
  .4 Thicknesses:
    .1 Chillers (except factory insulated): A-3, A-6 or C-4, 50 mm.
    .2 Expansion tanks: A-3, A-6 or C-4, 50mm
    .3 Air Separators: A-3, A-6 or C-4, 50mm
    .4 Heat exchangers (shell tube and plate): A-3, A-6 or C-4, 50mm.
    .5 Chilled water buffer tanks: A-3, A-6 or C-4, 50 mm.

.5 Finishes:
- .1 Engine exhaust piping and muffler: To TIAC code CRF-4.
- .2 Equipment in mechanical rooms: TIAC code CEF/1 with aluminum jacket.
- .3 Equipment elsewhere: TIAC code CEF/2 with 13 mm cement jacket.

3.4 REMOVABLE INSULATION COVERS

.1 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.2 Removable insulation covers shall be provided for the following:
- .1 Domestic water service entrance backflow preventer.
- .2 Domestic water service entrance pressure reducing valve assembly.
- .3 Domestic water service entrance O.S. & Y gate valve.
- .4 Domestic water service entrance copper connection butterfly valves NPS 2 1/2 and larger.
- .5 Domestic water service entrance wye - strainer.
- .6 Domestic hot water service pump assemblies.
- .7 Hydronic heating and chilled water system pump assemblies; - pumps, suction diffusers, triple duty valves.
- .8 Hydronic heating and chilled water system valves NPS 2 1/2 and larger -gate, globe and butterfly.
- .9 Hydronic heating and chilled water system flex connections, expansion joints.
- .10 Hydronic heating and chilled water system expansion tanks.
- .11 Hydronic heating and chilled water system air separators.
- .12 Hydronic heating and chilled water system plate and frame heat exchangers.
- .13 Hydronic heating and chilled water system shell and tube heat exchangers removable heads.
- .14 Balancing valves NPS 2 1/2 and above.
- .15 Two-Way Control valves NPS 2 1/2 and larger.
- .16 Three-Way Control valves NPS 2 1/2 and larger.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
.2 Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.
.3 Section 23 21 13.33 - Vertical Closed-Circuit Geothermal Heat Exchanger.
.4 Section 23 21 13.33 - Ground Loop Heat-Pump Piping.
.5 Section 23 21 14 - Hydronic Specialties.
.6 Section 23 21 15 - Hydronic Systems - Copper.
.7 Section 23 21 16 - Hydronic Systems - Steel.
.8 Section 23 21 17 - Press Joint Piping Systems for Hydronic Systems.
.9 Section 23 21 23 - Hydronic Pumps.
.10 Section 23 25 00 - HVAC Water Treatment Systems.
.11 Section 23 81 40 - Ground-Source Unitary Heat Pumps.
.12 Division 25 - Integrated Automation.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.4 CLOSED-LOOP GEOTHERMAL SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Perform system performance verification after the closed-loop geothermal system has been cleaned, flushed, filled, vented, and balanced.
.2 Operate the system until flow rates, pressures, and fluid temperatures have stabilized.
.3 Measure and record:
  .1 Total ground-loop flow rate.
  .2 Flow rate through each ground-loop circuit, branch, or manifold where flow-measuring devices are provided.
  .3 Ground-loop supply and return pressures at the building distribution.
  .4 Differential pressure across the ground-loop field.
  .5 Pump suction pressure, discharge pressure, differential pressure, and operating speed.
  .6 System static-fill pressure with pumps stopped.
  .7 System operating pressure with pumps operating.
  .8 Glycol type and concentration.
.4 Confirm that:
  .1 Total system flow and measured circuit flows are within the tolerances specified in Section 23 05 93.
  .2 Ground-loop pumps operate within the manufacturer’s recommended operating range.
  .3 Required flow is available to each operating ground-source heat pump.
  .4 System pressures remain within the design limits of the piping, pumps, heat pumps, valves, fittings, and accessories.
  .5 The system operates without leakage, air binding, cavitation, unstable flow, or abnormal noise and vibration.
.5 Submit recorded measurements, specified values, TAB values, identified deficiencies, and corrective work performed.

1.5 CLOSED-LOOP GEOTHERMAL THERMAL PERFORMANCE

.1 Perform thermal performance verification after hydronic testing and balancing have been completed and the system has reached stable operating conditions.

.2 Measure and record simultaneously at the building ground-loop headers:

- .1 Ground-loop supply temperature.
- .2 Ground-loop return temperature.
- .3 Total ground-loop flow rate.
- .4 Number of ground-source heat pumps operating.
- .5 Operating mode of the system, identified as heat extraction from or heat rejection to the ground loop.

.3 Calculate the rate of heat transfer to or from the ground loop using:

- .1 Measured total system flow.
- .2 Measured ground-loop supply and return temperatures.
- .3 Density and specific heat of the installed glycol solution at the measured mean-fluid temperature.

.4 Do not use the physical properties of water where the system contains glycol.

.5 Compare the measured operating conditions and calculated heat transfer with the design values applicable to the actual number and operating mode of the ground-source heat pumps in operation.

.6 Where the available building load is insufficient to produce design heating or cooling conditions, verify performance at the available load and record the limitations of the test. Do not artificially alter equipment safeties or operating limits to produce design conditions.

.7 Submit measured data, calculations, design comparison, glycol properties used in the calculations, instrument identification, identified deficiencies, and corrective work performed.

1.6 GLYCOL SYSTEMS

.1 Test the completed system to verify that it contains the specified propylene-glycol solution. Confirm a concentration by volume using a test instrument suitable for propylene glycol. Submit the measured concentration and corresponding freeze-protection temperature to the Consultant.

1.7 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:

- .1 Verify performance of equipment and systems as specified elsewhere in Division 23.
- .2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
- .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

1.8 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS

.1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 23.

.2 Verification of controls, detection devices, alarm devices is specified Division 26.

.3 Demonstrate that fire hose will reach to most remote location regardless of partitions, and obstructions.

.4 Verify operation of interlocks between HVAC systems and fire alarm systems.

1.9 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Buried systems: perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.

.2 Ensure that traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system.

.4 Operate flush valves, tank and operate each fixture to verify drainage and no leakage.

.5 Cleanouts: refer to Section 22 42 01 - Plumbing Specialties And Accessories
.6 Roof drains:
  .1 Refer to Section 22 42 01 - Plumbing Specialties And Accessories
  .2 Remove caps as required.

1.10 REPORTS

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, supplemented as specified herein.

1.11 TRAINING

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O&M Personnel, supplemented as specified herein.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section includes:
  .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 RELATED SECTIONS

.1 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
.2 Section 23 25 00 - HVAC Water Treatment Systems.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
.2 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.
  .1 Instructions: submit manufacturer's installation instructions.
    .1 Consultant will make available one (1) copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
  .1 Deliver, store and handle in accordance with manufacturer's written instructions and Division 01 - General Requirements.
.2 Waste Management and Disposal:
  .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Division 01 - General Requirements.

2 Products

2.1 CLEANING SOLUTIONS

.1 Low-foaming detergent: at all temperatures.
.2 Designed for use on most metals including aluminum.
.3 No pH neutralization required.
.4 Phosphate free.
.5 Biodegradable.
.6 Nitrate Free.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 CLEANING HYDRONIC AND STEAM SYSTEMS

.1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.

.2 Cleaning Agency:

.1 Retain qualified water treatment specialist to perform system cleaning.

.3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.

.4 Cleaning procedures:

.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:

.1 Cleaning procedures, flow rates, elapsed time.

.2 Chemicals and concentrations used.

.3 Inhibitors and concentrations.

.4 Specific requirements for completion of work.

.5 Special precautions for protecting piping system materials and components.

.6 Complete analysis of water used to ensure water will not damage systems or equipment.

.5 Conditions at time of cleaning of systems:

.1 Systems: free from construction debris, dirt and other foreign material.

.2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.

.3 Strainers: clean prior to initial fill.

.4 Install temporary filters on pumps not equipped with permanent filters.

.5 Install pressure gauges on strainers to detect plugging.

.6 Report on Completion of Cleaning:

.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.7 Hydronic Systems:

.1 Flush system thoroughly with water, back flush pump, strainers, blow down drain valves and risers to remove loose debris. Remove accumulated sludge in boilers.

.2 Add 2% solution of low foaming detergent to the system through a bypass feeder or another feeding device.

.3 Closed loop systems: circulate system cleaner at 820 degrees C for at least 36 hours. For chiller systems, circulate at least 48 hours at ambient temperature.

.4 During recirculation, back flush strainers, drain valves and risers at their lowest point once every 8 hours.

.5 Drain cleaning water completely.

.6 Fill and drain system several times. Circulate 30 minutes every time system is refilled.

.7 Blend system at secured points until water is clear and non foaming. Clean pump strainers.

.8 Draw a water sample from the system and send it to laboratory for analysis.

.9 If the laboratory report is unsatisfactory, repeat cleaning procedure.

.8 Glycol Systems:

.1 In addition to procedures specified above perform specified procedures.

.2 Test to prove concentration will prevent freezing to minus 40 degrees C. Test inhibitor strength and include in procedural report. Refer to ASTM E202.

3.3 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning is completed and system is filled:
- .1 Establish circulation and expansion tank level, set pressure controls.
- .2 Ensure air is removed.
- .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
- .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
- .5 Clean out strainers repeatedly until system is clean.
- .6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment Systems.
- .7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
- .8 Repeat with water at design temperature.
- .9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
- .10 Bring system up to design temperature and pressure slowly over a 48 hour period.
- .11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .12 Adjust pipe supports, hangers, springs as necessary.
- .13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
- .14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.
- .15 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .16 Check operation of drain valves.
- .17 Adjust valve stem packings as systems settle down.
- .18 Fully open balancing valves (except those that are factory-set).
- .19 Check operation of over-temperature protection devices on circulating pumps.
- .20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.4 CLEANING

.1 Proceed in accordance with Division 01 - General Requirements.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 RELATED SECTIONS

.1 Section 07 92 00 - Joint Sealants.
.2 Section 23 05 54 - Mechanical Identification.
.3 Section 23 07 14 - Thermal Insulation for Equipment.

1.3 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  .1 ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.
.2 American Society for Testing and Materials International (ASTM)
  .1 ASTM B209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
  .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  .3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  .5 ASTM C533, Calcium Silicate Block and Pipe Thermal Insulation.
  .6 ASTM C547, Mineral Fiber Pipe Insulation.
  .7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  .8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  .9 ASTM D184, Standard Specification for Rigid Poly (Vinyl Chloride) (PUC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
.3 Canadian General Standards Board (CGSB)
  .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts.
.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).
.5 Manufacturer's Trade Associations
  .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
.6 Underwriters' Laboratories of Canada (ULC)
  .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
  .2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  .3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings.
  .4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.
.7 National Energy Code of Canada for Buildings (NECB).

1.4 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:
.1 CRF: Code Rectangular Finish.
.2 CPF: Code Piping Finish.

1.5 SUBMITTALS

.1 Submittals: in accordance with Division 01 - General Requirements.
.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 01 - General Requirements.
.3 Shop Drawings:
.1 Submit shop drawings in accordance with Division 01 - General Requirements.
.4 Samples:
.1 Submit samples in accordance with Division 01 - General Requirements.
.2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.
.5 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.
.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions to Owner's Representative.

1.6 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.
.2 Health and Safety:
.1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with manufacturer's written instructions and Division 01 - General Requirements.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
.2 Storage and Protection:
.1 Protect from weather, construction traffic.
.2 Protect against damage.
.3 Store at temperatures and conditions required by manufacturer.
.3 Waste Management and Disposal:
.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Division 01 - General Requirements.

.2 Place excess or unused insulation and insulation accessory materials in designated containers.
.3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
.4 Dispose of unused adhesive material at official hazardous material collections site approved by Consultant.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.
  .1 Maximum flame spread rating: 25.
  .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
  .1 Mineral fibre: to CAN/ULC-S702.
  .2 Maximum "k" factor: to CAN/ULC-S702.
.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
  .1 Mineral fibre: to CAN/ULC-S702.
  .2 Jacket: to CGSB 51-GP-52Ma.
  .3 Maximum "k" factor: to CAN/ULC-S702.
.5 TIAC Code C-2: mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  .1 Mineral fibre: to CAN/ULC-S702.
  .2 Jacket: to CGSB 51-GP-52Ma.
  .3 Maximum "k" factor: to CAN/ULC-S702.
.6 TIAC Code A-6: flexible unicellular tubular elastomer.
  .1 Insulation: with vapour retarder jacket.
  .2 Jacket: to CGSB 51-GP-52Ma.
  .3 Maximum "k" factor: 0.039 w/m - °C
  .4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.
.7 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
  .1 Insulation: to ASTM C533.
  .2 Maximum "k" factor: to 0.75 w/m °C @ 500°c.
  .3 Design to permit periodic removal and re-installation.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.
.2 Contact adhesive: quick setting.
.3 Canvas adhesive: washable.
.4 Tie wire: 1.5 mm diameter stainless steel.
.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:
  .1 Hydraulic setting or air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.
.2 Reinforcing fabric: fibrous glass, untreated 305 g/m2.

2.8 JACKETS

.1 Polyvinyl Chloride (PVC):
- .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
- .2 Colours: to match adjacent finish paint.
- .3 Minimum service temperatures: -20°C.
- .4 Maximum service temperature: 65°C.
- .5 Moisture vapour transmission: 0.02 perm.
- .6 Thickness: 0.55 mm.
- .7 Fastenings:
  - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
  - .2 Tacks.
  - .3 Pressure sensitive vinyl tape of matching colour.
- .8 Special requirements:
  - .1 Indoor: flame spread rating 25, smoke developed rating 50.
  - .2 Outdoor: UV rated material at least 0.5 mm thick.

.2 ABS Plastic:
- .1 One-piece moulded type and sheet with pre-formed shapes as required.
- .2 Colours: to match adjacent finish paint.
- .3 Minimum service temperatures: -40°C.
- .4 Maximum service temperature: 82°C.
- .5 Moisture vapour transmission: 0.012 perm.
- .6 Thickness: 0.75 mm.
- .7 Fastenings:
  - .1 Solvent weld adhesive compatible with insulation to seal laps and joints.
  - .2 Tacks.
  - .3 Pressure sensitive vinyl tape of matching colour.
- .8 Locations:
  - .1 For outdoor use ONLY.

.3 Canvas:
- .1 220 gm/m2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.

.4 Aluminum:
- .1 To ASTM B209.
- .2 Thickness: 0.50 mm sheet.
- .3 Finish: smooth.
- .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
- .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
- .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

.5 Stainless steel:
- .1 Type: 304.
- .2 Thickness: 0.25 mm.

.3 Finish: smooth.
.4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
.5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
.6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 00 - Joint Sealants

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.
.2 Apply materials in accordance with manufacturers instructions and this specification.
.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Install hangers, supports outside vapour retarder jacket.
.5 Supports, Hangers:
.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 See Section 23 07 14 - Thermal Insulation for Equipment.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.
.2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
.2 TIAC Code: A-1.
.1 Securements: SS wire at 300 mm on centre.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code 1501-H.
.3 TIAC Code: A-3.
.1 Securements: SS wire at 300 mm on centre.
.2 Seals: VR lap seal adhesive, VR lagging adhesive.
.3 Installation: TIAC Code: 1501-C.
.4 TIAC Code: A-6.
.1 Insulation securements: as per manufacturer's recommendation.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-CA.
.5 TIAC Code: C-2 vapour retarder jacket.
.1 Insulation securements: 18 ga SS wire, or 12mm x 0.5mm SS bands at 300mm o.c.

.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.6 TIAC Code: A-2.
.1 Insulation securements: 18 ga SS wire, or 12mm x 0.5mm SS bands at 300mm o.c.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-H.

.7 Thickness of insulation as listed in following table.
.1 Run-outs to individual units and equipment not exceeding 4000 mm long.
.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

APPLICATION	Temp °C	TIAC Code	Pipe Sizes (NPS) & Insul. Thickness (mm)					
			Run Out	To 1	$1^{1/4}$ to 2	$2^{1/2}$ to 4	5to 6	8 & over
Hot Water Heating	60-94	A-1	25	38	50	50	50	50
Hot Water Heating	Up to 59	A-1	25	25	38	38	38	38
Glycol Heating	60-94	A-1	25	38	50	50	50	50
Glycol Heating	Up to 59	A-1	25	25	38	38	38	38
Domestic HWS	--	A-1	25	38	25	38	38	38
Geothermal Water or Glycol	4-50	A-3	25	25	38	38	38	38
Chilled Water Pump Casing	--	A-3	25	25	25	25	25	25
Refrigerated Drinking Water	--	A-3	25	25	25	25	25	25
Domestic CWS	--	A-3	25	25	25	25	25	25
Domestic CWS with Vapour Retarder	--	C-2	25	25	25	25	25	25

.8 Finishes:
.1 Exposed indoors: PVC jacket.
.2 Exposed in mechanical rooms: PVC jacket.
.3 Concealed, indoors: canvas on valves, fittings. No further finish.
.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
.5 Outdoors: water-proof aluminum jacket or stainless steel jacket.
.6 Finish attachments: SS screws, at 150 mm on centre. Seals: wing or closed.
.7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

.1 Proceed in accordance with Division 01 - General Requirements.
.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section includes:
  .1 The supply and installation of hydronic specialties equipment.

1.2 RELATED SECTIONS

.1 Section 23 05 01 - Installation of Pipework.
.2 Section 23 08 01 - Performance Verification of Mechanical Piping Systems.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME).
  .1 ASME, Boiler and Pressure Vessel Code.
.2 American Society for Testing and Materials, (ASTM).
  .1 ASTM A47/A47M, Specification for Ferritic Malleable Iron Castings.
  .2 ASTM A278M, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (345 degrees C).
  .3 ASTM A516/A516M, Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
  .4 ASTM A536, Specification for Ductile Iron Castings.
  .5 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
.3 Canadian Standards Association (CSA International).
  .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

1.4 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.
  .1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .2 Indicate on product data expansion tanks, air vents, separators, valves and strainers.
.3 Closeout Submittals:
  .1 Submit maintenance data in accordance with Division 01 - General Requirements.

1.5 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.6 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:
  .1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
  .2 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

2 Products

2.1 CANADIAN REGISTRATION NUMBER (CRN)

.1 Required on all products as per Provincial Regulations and CSA B51.

2.2 DIAPHRAGM TYPE EXPANSION TANK

.1 Horizontal or vertical as indicated, steel pressurized diaphragm type expansion tank.

.2 Capacity: as indicated.
.3 Size and acceptance volume: as indicated.
.4 Diaphragm sealed in elastomer or EPDM (always use EPDM for glycol systems) suitable for 115 degrees C operating temperature.
.5 Working pressure: 860 kPa with ASME stamp and certification, where required.
.6 Air precharged to 84 kPa (initial fill pressure of system) or as indicated.
.7 Saddles for horizontal installation, base mount for vertical installation.
.8 Supports: provide supports with hold down bolts and installation templates.
.9 On tanks larger than 44 Gallons provide replaceable bladder/diaphragm.
.10 Acceptable Material: Amtrol, Bell & Gossett, Taco, Armstrong

2.3 AUTOMATIC AIR VENT

.1 Standard float vent: brass body and NPS 1/8 connection and rated at 1000 kPa working pressure.
.2 Industrial float vent: ASTM A48 Class 30, cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure.
.3 Float: solid material suitable for 115 degrees C working temperature.

2.4 COALESCING AIR AND DIRT SEPARATOR

.1 Provide in-line coalescing air and dirt separator designed to continuously remove free air, entrained air, microbubbles, and suspended solids from the closed-loop hydronic system.
.2 Separator shall include permanent stainless-steel coalescing media. Centrifugal or vortex-type separators without coalescing media are not acceptable.
.3 Separator shall be suitable for the specified inhibited propylene-glycol solution and the system design flow, pressure, and temperature.
.4 Select separator for a pressure drop not exceeding 15 kPa at design flow and within the manufacturer’s recommended flow-velocity range.
.5 Provide steel body with system-compatible connections, automatic high-capacity air vent, dirt-collection chamber, and full-port bottom blowdown valve with capped hose connection.
.6 Provide ASME Section VIII construction and Canadian Registration Number.
.7 Basis of design: Taco 4900 Series, Spirotherm Spirovent, Bell & Gossett CRS series, Caleffi Discal.

2.5 COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE

.1 Adjustable pressure setting: 206 kPa relief, 55 to 172 kPa reducing.
.2 Low inlet pressure check valve.
.3 Removable strainer.

2.6 PIPE LINE STRAINER

.1 NPS 1/2 to 2: bronze body to ASTM B62, solder or screwed end connections, Y pattern.
.2 NPS 2 1/2 to 12: cast steel body to ASTM A278M, Class 30, connections.
.3 NPS 2 to 12: T type with ductile iron body to ASTM A536 or malleable iron body to ASTM A47M, grooved ends.
.4 Blowdown connection: NPS 1.
.5 Screen: stainless steel with 1.19 mm perforations.
.6 Working pressure: 860 kPa.
.7 Acceptable material: Watts 7775, Hoffman, Wilkins, Victaulic, Armstrong.

2.7 SUCTION DIFFUSER

.1 Body: cast iron with flanged or grooved ductile iron connections. 2.1 mPa.
.2 Strainer: with built-in, disposable 1.19 mm mesh, low pressure drop screen and NPS 1 connection.
.3 Permanent magnet particle trap.
.4 Full length straightening vanes.

.5 Pressure gauge tappings.
.6 Adjustable support leg.
.7 Acceptable Material: Bell and Gossett, Victaulic, Taco, Armstrong.

2.8 TRIPLE DUTY VALVE

.1 Centre-guided non-slam drip tight check valve.
.2 Positive shut off valve.
.3 Calibrated system balancing valve.
.4 Straight pattern as indicated.
.5 Flanged or grooved end connections.
.6 Soft seat design for positive sealing.
.7 Construction:
  .1 Body: cast iron with bronze seat.
  .2 Disc: bronze with EPDM seat insert.
  .3 Stem: stainless steel.
  .4 Spring: stainless steel.
  .5 Packing: Teflon - graphite (asbestos free).
  .6 Gasket: asbestos free.
  .7 Readout Valve: brass with EPT insert, check valve and gasket.
  .8 Maximum operating temperature 121 C.
  .9 Maximum hourly pressure: 1.2 mPa.
  .10 Valve design shall permit repacking under full system pressure.
  .11 Provide complete with brass readout valves, integral check feature, to facilitate taking differential pressure readings across the orifice for accurate system balance.
  .12 Provide CU rating at 10% increments. Manufacturer shall supply the CU rating for readout of flow determination and system pressure drop.
  .13 Capacity: see schedule on drawings for performance criteria and model selection.
  .14 Acceptable Material: Bell and Gossett, Victaulic, Taco, Armstrong.

3 Execution

3.1 GENERAL

.1 Install as indicated and to manufacturer's recommendations.
.2 Run drain lines and blow off connections to terminate above nearest drain.
.3 Maintain proper clearance to permit service and maintenance.
.4 Should deviations beyond allowable clearances arise, request and follow Consultant's directive.
.5 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

3.2 STRAINERS

.1 Install in horizontal or down flow lines.
.2 Ensure clearance for removal of basket.
.3 Install ahead of each pump.
.4 Install ahead of each automatic control valve larger than NPS 1 and as indicated.

3.3 AIR VENTS

.1 Install at high points of systems in piping mains. The Contractor shall provide automatic air eliminators in order to avoid air pockets in the system. Air vents are to be installed at an accessible place with the aid of necessary piping in order to facilitate maintenance.
.2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain or service sink.

3.4 EXPANSION TANKS

.1 Adjust expansion tank pressure to suit design criteria.
.2 Install lockshield type valve at inlet to tank.

3.5 PRESSURE SAFETY RELIEF VALVES

.1 Run discharge pipe to terminate above nearest drain.

3.6 SUCTION DIFFUSERS

.1 Install on inlet to pumps having suction size greater than 50.

3.7 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping Systems, supplemented as specified herein.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/American Welding Society (AWS)
  .1 ANSI/AWS A5.8/A5.8M, Specification Filler Metals for Brazing and Bronze Welding.
.2 American Society of Mechanical Engineers (ASME)
  .1 ANSI/ASME B16.4, Gray-Iron Threaded Fittings.
  .2 ANSI/ASME B16.15, Cast Bronze Threaded Fittings.
  .3 ANSI B16.18, Cast Copper Alloy, Solder Joint Pressure Fittings.
  .4 ANSI/ASME B16.22, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.
.3 American Society for Testing and Materials International (ASTM)
  .1 ASTM B32, Standard Specification for Solder Metal.
  .2 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
  .3 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  .4 ASTM B88M, Standard Specification for Seamless Copper Water Tube Metric.
  .5 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).
.5 Manufacturers Standardization Society (MSS)
  .1 MSS SP67, Butterfly Valves.
  .2 MSS SP70, Cast Iron Gate Valves, Flanged and Threaded Ends.
  .3 MSS SP71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  .4 MSS SP80, Bronze Gate, Globe, Angle and Check Valves.
  .5 MSS SP85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
    .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 01 - General Requirements.
.2 Shop Drawings:
  .1 Submit shop drawings in accordance with Division 01 - General Requirements.
  .2 Indicate on manufacturers catalogue literature the following: VALVES.
.3 Quality assurance submittals: submit following in accordance with Division 01 - General Requir.
  .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .2 Instructions: submit manufacturer's installation instructions.
    .1 Consultant will make available 1 copy of systems supplier's installation instructions.
.4 Closeout Submittals:
  .1 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.3 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial/Territorial regulations.
.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.4 MAINTENANCE

.1 Extra Materials:
  .1 Furnish following spare parts:
    .1 Valve seats: one for every ten valves, each size. Minimum one.
    .2 Discs: one for every ten valves, each size. Minimum one.
    .3 Stem packing: one for every ten valves, each size. Minimum one.
    .4 Valve handles: two of each size.
    .5 Gaskets for flanges: one for every ten flanges.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
  .1 Deliver, store and handle in accordance with manufacturer's written instructions and Division 01 - General Requirements.
.2 Waste Management and Disposal:
  .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Division 01 - General Requirements.

2 Products

2.1 TUBING

.1 Type A hard drawn copper tubing: to ASTM B88M.

2.2 FITTINGS

.1 Cast bronze threaded fittings: to ANSI/ASME B16.15.
.2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22.
.3 Cast iron threaded fittings: to ANSI/ASME B16.4.
.4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18.

2.3 FLANGES

.1 Brass or bronze: threaded.
.2 Cast iron: threaded.
.3 Orifice flanges: slip-on, raised face, 2100 kPa.

2.4 JOINTS

.1 Solder, tin-antimony, 95:5: to ASTM B32.
.2 Silver solder BCUP: to ANSI/AWS A5.8.
.3 Brazing: as indicated.

2.5 VALVES

.1 Connections:
  .1 NPS 2 and smaller: ends for soldering.
  .2 NPS 2 1/2 and larger: grooved ends.
.2 Ball valves:
  .1 NPS 2 and under: as specified Section 23 05 22 - Valves - Bronze.
.3 Gate valves:
  .1 NPS 2 and under:
    .1 Mechanical Rooms: Class 125, rising stem split wedge disc, as specified Section 23 05 22 - Valves - Bronze.
    .2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 22 - Valves - Bronze.

.2 NPS 2 1/2 and over:
.1 Mechanical Rooms: stem, split wedge disc, bronze trim, as specified Section 23 05 23 - Valves - Cast Iron.
.2 Elsewhere: rising stem, solid wedge disc, bronze trim, as specified Section 23 05 23 - Valves - Cast Iron.

.4 Butterfly valves:
.1 NPS 2 1/2 and over: grooved ends: as specified Section 23 05 17 - Pipe Welding.

.5 Globe valves: application: throttling, flow control, emergency bypass:
.1 NPS 2 and under:
.1 Mechanical Rooms: with PFTE disc, as specified Section 23 05 22 - Valves - Bronze.
.2 Elsewhere: globe, with composition disc, as specified Section 23 05 22 - Valves - Bronze.
.2 NPS 2 1/2 and over:
.1 With composition disc, bronze trim, as specified Section 23 05 23 - Valves - Cast Iron.

.6 Balancing, for TAB:
.1 Sizes: calibrated balancing valves, as specified.
.2 NPS 2 and under:
.1 Mechanical Rooms: globe, with plug disc as specified Section 23 05 22 - Valves - Bronze.
.2 Elsewhere: globe, with plug disc as specified Section 23 05 22 - Valves - Bronze.

.7 Drain valves: gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 22 - Valves - Bronze.

.8 Bypass valves on globe valves NPS 8 and larger: NPS 3/4, globe, with PFTE disc as specified Section 23 05 22 - Valves - Bronze.

.9 Swing check valves:
.1 NPS 2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 22 - Valves - Bronze.
.2 NPS 2 1/2 and over:
.1 Grooved ends: as specified Section 23 05 23 - Valves - Cast Iron.

.10 Silent check valves:
.1 NPS 2 and under:
.1 As specified Section 23 05 22 - Valves - Bronze.
.2 NPS 2 1/2 and over:
.1 Grooved ends: as specified Section 23 05 23 - Valves - Cast Iron.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PIPING INSTALLATION

.1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.

.3 Slope piping in direction of drainage and for positive venting.

.4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
.6 Assemble piping using fittings manufactured to ANSI standards.

3.3 VALVE INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.
.2 Install butterfly valves on chilled water and condenser water lines only.
.3 Install ball valves at branch take-offs and to isolate each piece of equipment, and as indicated.
.4 Install globe valves for balancing and in by-pass around control valves as indicated.
.5 Install silent check valves on discharge of pumps, in vertical pipes with downward flow and as indicated.
.6 Install swing check valves in horizontal lines on discharge of pumps and as indicated.
.7 Install chain operators on valves NPS 2 1/2 and over where installed more than 2400 mm above floor in Boiler Rooms and mechanical equipment rooms.
.8 Install ball valves for glycol service.

3.4 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.
.2 Remove handwheel after installation and TAB is complete.
.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.5 FLUSHING AND CLEANING

.1 Flush and clean in presence of Consultant.
.2 Flush after pressure test for a minimum of 4h.
.3 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8h.
.4 Refill system with clean water. Circulate for at least 4h. Clean out strainer screens/baskets regularly. Then drain.
.5 Refill system with clean water. Circulate for at least 2h. Clean out strainer screens/baskets regularly. Then drain.
.6 Drainage to include drain valves, dirt pockets, strainers, low points in system.
.7 Re-install strainer screens/baskets only after obtaining Consultant's approval.

3.6 FILLING OF SYSTEM

.1 Refill system with clean water adding water treatment as specified or glycol as required.

3.7 FIELD QUALITY CONTROL

.1 Testing:
  .1 Test system in accordance with Section 23 05 00 - Common Work Results - Mechanical.
  .2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.
.2 Balancing:
  .1 Balance water systems to within plus or minus 5% of design output.
  .2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing For HVAC.
.3 Glycol Charging:
  .1 Provide mixing tank and positive displacement pump for glycol charging.
  .2 Retest for concentration to ASTM E202 after cleaning.
  .3 Provide report to Consultant.

3.8 CLEANING

.1 Proceed in accordance with Division 01 - General Requirements.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for steel piping, valves, and fittings for hydronic systems in building service piping including:
  - .1 Hot water heating piping
  - .2 Chilled water piping
  - .3 Condenser water piping
  - .4 Makeup water piping
  - .5 Air vent piping
  - .6 Safety valve inlet and outlet piping

1.2 RELATED SECTIONS

.1 Section 23 05 00 - Common Work Results for HVAC.
.2 Section 23 05 17 - Pipe Welding.
.3 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
.4 Section 23 05 01 - Installation of Pipework.
.5 Section 23 05 22 - Valves - Bronze.
.6 Section 23 05 23 - Valves - Cast Iron.
.7 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
.8 Section 23 08 01 - Performance Verification of Mechanical Piping Systems.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME).
- .1 ASME B16.1-, Cast Iron Pipe Flanges and Flanged Fittings.
- .2 ASME B16.3-, Malleable Iron Threaded Fittings.
- .3 ASME B16.5-, Pipe Flanges and Flanged Fittings.
- .4 ASME B16.9-, Factory-Made Wrought Buttwelding Fittings.
- .5 ASME B18.2.1-, Square and Hex Bolts and Screws (Inch Series).
- .6 ASME B18.2.2-, Square and Hex Nuts (Inch Series).

.2 American Society for Testing and Materials International, (ASTM).
- .1 ASTM A47/A47M-, Standard Specification for Ferritic Malleable Iron Castings.
- .2 ASTM A53/A53M-, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
- .3 ASTM A536-, Standard Specification for Ductile Iron Castings.
- .4 ASTM B61-, Standard Specification for Steam or Valve Bronze Castings.
- .5 ASTM B62-, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .6 ASTM E202-, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

.3 American Water Works Association (AWWA).
- .1 AWWA C111-, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).
- .1 CSA B242-, Groove and Shoulder Type Mechanical Pipe Couplings.
- .2 CAN/CSA W48-, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
- .1 MSS-SP-67-, Butterfly Valves.
- .2 MSS-SP-70-, Cast Iron Gate Valves, Flanged and Threaded Ends.
- .3 MSS-SP-71-, Cast Iron Swing Check Valves Flanged and Threaded Ends.
- .4 MSS-SP-80-, Bronze Gate, Globe, Angle and Check Valves.
- .5 MSS-SP-85-, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

.6 Province of Prince Edward Island Boiler and Pressure Vessel Act and Regulations.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.
- .1 Product Data: for each type of the following:
  - .1 Pipe materials.
  - .2 Unions and flanges, including gaskets, nuts and bolts.
  - .3 Welding Fittings.
  - .4 Groove and joint couplings and fittings.
  - .5 Sleeves and packing.
  - .6 Pressure seal fittings.
  - .7 Valves: include flow and pressure drop curves based on manufacturers testing for calibrated-orifice balancing valves and automatic flow control valves.
  - .8 Air control devices.
  - .9 Chemical treatment.
  - .10 Hydronic specialties: submit schedule listing type, make, model and model number, size and service for all hydronic specialties.

.2 Closeout Submittals.
- .1 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements and include following:
  - .1 Special servicing requirements.

.3 Groove joint couplings and fittings to be indicated on product submittals and to be specifically identified with the applicable style or series designation.

.4 Grooved products manufacturer to supply on site tools and products for installation training.

.5 All groove products to be of one manufacturer.

.6 Groove products to have current CRN numbers.

1.5 QUALITY ASSURANCE

.1 Health and Safety.
- .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal.
- .1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

1.7 MAINTENANCE

.1 Extra Materials.
- .1 Provide following spare parts:
  - .1 Valve seats: one for every ten valves, each size. Minimum one.
  - .2 Discs: one for every ten valves, each size. Minimum one.
  - .3 Stem packing: one for every ten valves, each size. Minimum one.
  - .4 Valve handles: two of each size.
  - .5 Gaskets for flanges: one for every ten flanges.

2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
- .1 Up to NPS 2: Schedule 40.
- .2 NPS 2-1/2 and 10: Schedule 10.
- .3 NPS 12 and over, 10 mm wall thickness.

2.2 PIPE JOINTS

.1 NPS2 and under: screwed fittings with PTFE tape or lead-free pipe dope.
.2 NPS2-1/2 and over: welding fittings and flanges to CAN/CSA W48.
.3 Roll grooved: standard coupling to CSA B242.
.4 Flexible couplings to CSA B242 to be used where noted on drawings and on elbows utilized on expansion joints.
.5 Flanges: plain ASME B16.1 or raised face, slip-on or weld neck to ASME B16.5.
.6 Orifice flanges: slip-on raised face, 2100 kPa.
.7 Flange gaskets: to AWWA C111.
.8 Pipe thread: taper.
.9 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.
.10 Roll grooved coupling gaskets: type EPDM - 40% to 120 deg C for continuous operation using hot water, glycol water, chilled water or condenser water.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.
.2 Pipe flanges and flanged fittings:
- .1 Cast iron: to ASME B16.1, Class 125.
- .2 Steel: to ASME B16.5.

.3 Butt-welding fittings: steel, to ASME B16.9.
.4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.
.5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M, ductile iron to ASTM A536.

2.4 VALVES

.1 Connections:
- .1 NPS2 and smaller: screwed ends.
- .2 NPS 21/2 and larger: grooved ends.

.2 Ball valves:
- .1 NPS 2 and under: as specified in Section 23 05 22 - Valves - Bronze.

.3 Gate valves: to MSS-SP-70:
- .1 NPS 2 and under:
  - .1 Mechanical Rooms : Class 125, rising stem, split wedge disc, as specified Section 23 05 22 - Valves - Bronze.
  - .2 Elsewhere: Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 22 - Valves - Bronze.
- .2 NPS 21/2 and over:
  - .1 Mechanical Rooms: stem, split wedge disc, lead free trim, as specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.
  - .2 Elsewhere: rising stem, solid wedge disc, lead free trim, as specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.

.4 Butterfly valves: to MSS-SP-67:
- .1 NPS 21/2 and over: Lug type: as specified Section 23 05 26 - Butterfly Valves.

.5 Globe valves: to MSS-SP-80:
- .1 NPS2 and under:
  - .1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 22 - Valves - Bronze.

.2 Elsewhere: Globe, with composition disc, as specified Section 23 05 22 - Valves - Bronze.
.2 NPS21/2 and over:
.1 With composition disc, lead free trim, as specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.
.6 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 22 - Valves - Bronze.
.7 Bypass valves on globe valves NPS 8 and larger: NPS 3/4, Globe, with PTFE disc as specified Section 23 05 22 - Valves - Bronze.
.8 Swing check valves: to MSS-SP-71.
.1 NPS2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 22 - Valves - Bronze.
.2 NPS21/2 and over:
.1 Grooved ends: as specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.
.9 Silent check valves:
.1 NPS2 and under:
.1 As specified Section 23 05 22 - Valves - Bronze.
.2 NPS21/2 and over:
.1 Grooved ends: as specified Section 23 05 23 - Valves - Cast Iron: Gate, Globe, Check.
.10 Glycol:
.1 Ethylene glycol with inhibitors for corrosion control.
.2 Percentage volume as indicated.
.11 Combination balancing and shutoff valves NPS 2 and smaller.
.1 Body: brass, stainless steel, bronze or a metal ball or y-pattern.
.2 Seat: PTFE or a metal
.3 End connection: threaded or socket.
.4 Pressure gauge connections: integral seals for portable differential pressure meter.
.5 Handle style: digital hand wheel, with memory stop to retain set position.
.6 CWP rating: minimum 125 PSIG.
.7 Maximum operating temperature: 250 deg F.
.8 Acceptable material: Tour and Anderson, Xylem, Armstrong.
.12 Combination balancing and shut off valves NPS 2 1/2 and larger.
.1 Body: ductile icon or steel body, ball, plug or globe pattern with calibrated orifice or ventur:
.2 Stem Seals: EPPM 0-rings.
.3 Disc: Elassor carbon filled PTFE
.4 Seat: PTFE
.5 End connections: flanged or grooved.
.6 Pressure gauge connections: integral seal for portable differential meter.
.7 Handle style: digital hand wheel with memory stop to retain set position.
.8 CWP rating: minimum 125 PSIG.
.9 Maximum operating temperature: 250 deg F.
.10 Acceptable material: Xylem, Tour and Anderson, Armstrong.

3 Execution

3.1 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 01 - Installation of Pipe Work.
.1 Install shutoff duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

.2 Install balancing valves at each branch connection to return main and return pipe of each heating or cooling terminal.

3.2 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.
.2 Remove handwheel after installation and when TAB is complete.
.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.3 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

3.4 TESTING

.1 Test system in accordance with Section 23 05 00 - Common Work Results - Mechanical. Minimum 1.5 times working pressure on 1000 KPa.
.2 For glycol systems, retest with propylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

3.5 BALANCING

.1 Balance water systems to within plus or minus 5 % of design output.
.2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

3.6 GLYCOL CHARGING

.1 Provide mixing tank and positive displacement pump for glycol charging.
.2 Retest for concentration to ASTM E202 after cleaning.

3.7 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping Systems.
.2 Provide copies of test reports for commissioning manuals.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 23 05 00 - Common Work Results for HVAC.
.2 Section 23 05 01 - Installation of Pipework.
.3 Section 23 05 22 - Valves - Bronze.
.4 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
.5 Section 23 08 01 - Performance Verification of Mechanical Piping Systems.
.6 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
  .2 ASTM A135, Standard Specification for Electric-Resistance-Welded Steel Pipe.
  .3 ASTM A795, Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
  .4 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
  .5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
  .6 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
.2 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
  .1 MSS-SP-71, Cast Iron Swing Check Valves Flanged and Threaded Ends.
  .2 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

1.3 SUBMITTALS

.1 Submit product data in accordance with .
.2 Submit data for following:
  .1 Valves.
  .2 Couplings, Components.
.3 Closeout Submittals.
  .1 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements and include following:
    .1 Special servicing requirements.

1.4 QUALITY ASSURANCE

.1 Health and Safety.
  .1 Do construction occupational health and safety in accordance withDivision 01 - General Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal.
  .1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
  .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  .3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  .4 Separate for reuse and place in designated containers Steel waste in accordance with Waste Management Plan.
  .5 Fold up metal banding, flatten and place in designated area for recycling.

1.6 MAINTENANCE

.1 Extra Materials.
  .1 Provide following spare parts:
    .1 Valve seats: One for every ten valves each size. Minimum one.
    .2 Discs: one for every ten valves, each size. Minimum one.
    .3 Stem packing: one for every ten valves, each size. Minimum one.
    .4 Valve handles: two of each size.
    .5 Gaskets for flanges: one for every ten flanged joints.

2 Products

2.1 PIPING

.1 Steel pipe: to ASTM A53/A53M, minimum wall thickness 1.45 mm and to supplier installation instructions.

2.2 FITTINGS

.1 Cold drawn steel complete with grade "C" Butylene or grade "T" Nitrile O-ring.

2.3 GATE VALVES

.1 Rising stem, screwed ends:
  .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 22 - Valves - Bronze.

2.4 GLOBE VALVES

.1 To MSS-SP-80, Class 125, 860 kPa, lead free bronze body, screw-over bonnet, stainless steel disc or renewable composition disc suitable for service, as specified in Section 23 05 22 - Valves - Bronze.

2.5 SWING CHECK VALVES

.1 To MSS-SP-71, Class 125, 860 kPa, lead free bronze body, screw-in cap, bronze swing disc, regrindable seat as specified Section 23 05 22 - Valves - Bronze.

2.6 BALL VALVES

.1 To ASTM B62, 4 MPa WOG, lead free bronze body, hard chrome solid ball, TFE seal, PTFE adjustable packing, PTFE seat, lever handle.

2.7 SILENT CHECK VALVES

.1 To ASTM B62, Class 125, 860 kPa, cast steel, wafer style, lead free brass seat rings, lead free brass inner valve, stainless steel spring heavy duty spring when in vertical down flow applications as specified Section 23 05 22 - Valves - Bronze.

2.8 LUBRICATED PLUG COCKS

.1 To ASTM B61, Class 150, 1 MPa, lead free bronze body.

2.9 CIRCUIT BALANCING VALVES (CBV)

.1 General:
  .1 Y style globe valve, designed to provide precise flow measurement and control, with valved ports for connected to differential pressure meter.
  .2 Accuracy:
    .1 Readout to be within plus or minus 2% of actual flow at design flow rate.

.2 Pressure die-cast dezincification resistant copper alloy or stainless steel construction, 1.7MPa, 121 degrees C, screwed ends, Teflon disc, screw-in bonnet.

.1 Flow control: at least four 4 full turns of handwheel with digital handwheel and tamperproof concealed mechanical memory.

.3 Insulation: use prefabricated shipping packaging of 5.4R polyurethane as insulation see valves thermal insulation.

.4 Drain connection:

.1 NPS3/4 valved and capped, suitable for hose socket.

.2 Incorporated into valve body or provided as separate item.

3 Execution

3.1 PIPING

.1 Install pipework in accordance with Section 23 05 01 - Installation of Pipework, supplemented as specified herein.

.2 Install press joint piping system in accordance with manufacturer's latest recommendations.

.3 Visibly mark both ends of pipe with proper insertion depths prior to assembly and installation.

3.2 VALVES

.1 Install valves as indicated in Section 23 05 22 - Valves - Bronze.

.2 Install calibrated balancing valves for balancing purposes as indicated.

3.3 PRESSURE TESTS

.1 Test system in accordance with Section 23 05 00 - Common Work Results - Mechanical.

.2 Test pressure: test with water to greater of 1 1/2 times maximum system operating pressure or 860 kPa.

3.4 CLEANING AND START UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.2 Flush and clean in presence of Consultant.

.3 Flush after pressure test for minimum of 4 hours.

.4 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8 hours.

.5 Refill system with clean water. Circulate for at least 4 hours. Clean out strainer screens/baskets regularly. Then drain.

.6 Refill system with clean water. Circulate for at least 2 hours. Clean out strainer screens/baskets regularly. Then drain.

.7 Drainage to include drain valves, dirt pockets, strainers, every low point in system.

.8 Re-install strainer screens/baskets after obtaining Consultant's approval.

.9 Refill system with clean water adding water treatment as specified.

3.5 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping Systems, supplemented as specified herein.

3.6 TESTING AND BALANCING

.1 Balance water systems to within plus or minus 5% of design output.

.2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures and to Section 23 05 00 - Common Work Results - Mechanical.

3.7 GLYCOL CHARGING

.1 Provide mixing tank and positive displacement pump for glycol charging.

.2 Retest for concentration to ASTM E202 after cleaning.

.3 Provide report to Consultant.

END OF SECTION

1 General

1.1 SUMMARY

.1 This Section includes pipe and fitting materials, joining methods and specialty items for the following:
  .1 Chilled Water piping.
  .2 Air control devices - air separators / expansion tanks.
  .3 Geothermal well piping.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM F 2389-07 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.
.2 Canadian Standards Association (CSA)
  .1 CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications.
.3 National Sanitation Foundation / American National Standards Institute (NSF / ANSI)
  .1 NSF/ANSI 14 - Plastic Piping System Components and Related Materials.

1.3 DEFINITIONS

.1 Definitions shall be in accordance with local mechanical codes and ASTM F 2389.

1.4 SUBMITTALS

.1 Submit product data in accordance with Division 01 - General Requirements.
.2 Material list naming each product to be used identified by manufacturer and product number, in accordance with Division 01 - General Requirements.
.3 Closeout Submittals.
  .1 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements and include following:
    .1 Special servicing requirements.

1.5 QUALITY ASSURANCE

.1 Material shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.
.2 Material shall comply with manufacturer's specifications.
.3 Special Engineered products shall be certified by NSF International as complying with NSF 14.

1.6 WASTE MANAGEMENT & DISPOSAL

  .1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
  .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  .3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  .4 Separate for reuse and place in designated containers Steel waste in accordance with Waste Management Plan.
  .5 Fold up metal banding, flatten and place in designated area for recycling.

1.7 MAINTENANCE

.1 Extra Materials - provide following spare parts:
  .1 Valve seats: One for every ten valves each size. Minimum one.
  .2 Discs: one for every ten valves, each size. Minimum one.

.3 Stem packing: one for every ten valves, each size. Minimum one.
.4 Valve handles: two of each size.
.5 Gaskets for flanges: one for every ten flanged joints.

1.8 HEALTH & SAFETY

.1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.9 WARRANTY

.1 Manufacturer shall warrant pipe and fittings for 10 years to be free of defects in materials or manufacturing.
.2 Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
.3 Warranty shall be in effect only upon submission by the contractor to the manufacturer valid pressure/leak test documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

2 Products

2.1 PIPE AND PIPING PRODUCTS

.1 Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Hydronic hot water and heating piping shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. All pipe shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

2.2 FITTINGS

.1 Fittings shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

2.3 VALVES

.1 Valves shall be manufactured in accordance with the manufacturer's specifications and shall comply with the performance requirements of ASTM F 2389 or CSA B137.11. The valves shall contain no rework or recycled thermoplastic materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.

2.4 SMOKE AND FIRE RATINGS

.1 Where indicated on the drawings that a Plenum-rated Piping System is needed, the pipe shall be wrapped and/or insulated with standard fiberglass or mineral wool pipe insulation, field installed, with bare fittings no closer than every 6 ft. of pipe. The pipe, wrap or insulation as a system shall meet the requirements of CAN/ULC-S102.2-03 or ASTM E84. The system shall have a Flame Spread Classification of less than 25 and Smoke Development rating of less than 50.

2.5 UV PROTECTION

.1 Where indicated on the drawings that the pipe will be exposed to direct UV light for more than 30 days, it shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.

2.6 THERMAL & VAPOR BARRIER

.1 Insulation materials furnished and installed hereunder should meet the minimum thickness requirements of American Society of Heating, Refrigeration, and Air Conditioning Engineers ASHRAE 90.1 (current edition), "Energy Efficient Design of New Buildings." However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor.

.2 Where standard pipe insulation is indicated on the drawings or in these specifications, the contractor shall provide a thermal (radiant, conductive, and convective) and vapor barrier insulation. The insulation products shall be provided in R-value and thickness as indicated in Section 23 20 21 - Thermal Insulation for Piping. The standard pipe insulation shall be UV resistant, mold growth resistant and not contain asbestos, lead, mercury, or mercury compounds.

.1 For indoor systems operating at temperatures from 0°F (-18°C) to 200°F (93°C) and pipe sizes from ½" (20mm) to 12" (315 mm).

.1 Acceptable material:

.1 Owens Corning TM Fiberglas TM Insulation for Aquatherm with ASJ Max® Positive Closure System, or approved equal.

3 Execution

3.1 PIPING APPLICATIONS

.1 Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

.2 Installers shall be trained and certified to install the pipe according to the manufacturer's guidelines.

.3 Install listed pipe materials and joining methods below in the following applications:

.1 Aboveground: Polypropylene (PP-R) piping in SDR 7.4, 9, 11, or 17.6 based on the required minimum pressure rating and use temperature, in accordance with manufacturer's instructions and ASTM F2389.

.4 Installation must be accomplished with the proper tools for installing piping following manufacturer's instructions.

.5 Install hydronic piping level and plumb.

.6 Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

3.2 FUSION WELDING OF JOINTS

.1 Install fittings and joints using socket-fusion, elecrofusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.

.2 Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.

.3 Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F 2389 and the manufacturer's specifications.

.4 Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

3.3 VALVE APPLICATIONS

.1 Install gate valves close to the main on each branch and riser serving 2 or more equipment connections and where indicated.
.2 Install gate or ball valves on the inlet to each equipment item and elsewhere as indicated.
.3 Install drain valve at the base of each riser, at low points of horizontal runs, and where required to drain hydronic piping system.
.4 Install swing check valve on the discharge side of each pump and elsewhere as indicated.
.5 Install ball valves in each hot-water circulating loop and the discharge side of each pump.

3.4 PIPING INSTALLATIONS

.1 Fire stopping shall be provided to both be compatible with the plastic piping and meet the requirements of ASTM E 814 or ULC S115 , "Fire Tests of Through-Penetration Firestops". Pipe insulations or fire resistive coating shall be removed where the pipe passes through a fire stop and, if required by the firestop manufacturer, for 3 inches beyond the firestop outside of the fire barrier.
.2 When installed in systems with pumps in excess of 7.5 HP, piping shall be protected from excessive heat generated by operating the pump at shut-off conditions. Where the possibility exists that the pump will operate with no flow, the protection method shall be a temperature relief valve or comparable level of protection, set to a maximum temperature of 185°F.
.3 If heat tracing or freeze protection is specified for the piping, it should be installed on the pipe interior or exterior. It must be suitable for use with plastic piping and be self-regulating to ensure that the surface temperature of the pipe and fittings will not exceed 70°C (158°F).

3.5 HANGER AND SUPPORT INSTALLATION

.1 Comply with requirements for pipe hanger, support products, and installation in Section 23 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
    .1 Vertical Piping: MSS Type 8 or 42, clamps
    .2 Individual, Straight, Horizontal Piping Runs:
        .1 Adjustable, steel clevis hangers.
        .2 Clamps on strut trapeze.
        .3 Clamps on strut attached to structure.
        .4 Clamps attached directly to the structure.
    .3 Base of Vertical Piping: MSS Type 52, spring hangers.
.2 Support vertical piping and tubing at base and at each floor. For piping 2" (63mm) or smaller, install mid-story guides.
.3 Install hangers and supports at intervals specified in the applicable Plumbing Code and/or as recommended by pipe manufacturer.
.4 Hanger and supports shall also be provided within 1-foot of every change of direction and within 1-foot of any pipe fittings and valves.
.5 For hot water piping, provide clamps and supports that are felt or rubber/vinyl coated or lined.
.6 For cold water piping supports and clamps may be bare metal. Ensure that the clamp or support does not have sharp edges that may scrape or gouge the piping.
.7 Use care when installing riser clamps to not over tighten the clamps to cause indentation of the pipe. Riser clamps shall be isolated from the building structure by placing felt or rubber pads between the clamp and the structure.
.8 All piping support materials shall be new and manufactured for the specific purpose of supporting systems, equipment, pipes and accessories. No improvised pipe support solutions shall be allowed.

3.6 EXPANSION AND CONTRACTION

.1 Provide expansion and contraction controls, guides and anchors to take into account the expansion and contraction of the pipe. Provide expansion loops or offsets as required and as indicated in the manufacturer's literature.
    .1 Install anchor points at least every 120 feet.

.2 Install expansion loop or offset between each anchor point. Expansion device must be able to absorb all the stresses between the two anchor points.

3.7 PRESSURE TESTING

.1 While still accessible all piping shall be pressure tested to 150 PSI and held for four (4) hours.
.2 Tests shall be carried out using water. The test pressure shall be as indicated in the pressure leak testing procedures required by the manufacturer.
.3 Any leaks detected shall be repaired at the contractor's expense by removing the leaking part and replacing with new parts welded per the pipe manufacturer's guidelines.

3.8 INSPECTING AND CLEANING

.1 The pipes shall be flushed with cold water after finishing the installation. Flush the system until the water runs clear of debris and dirt.
.2 Inspect and test piping systems following procedures of authorities having jurisdiction and as specified by the piping system manufacturer.
.3 Clean and disinfect water distribution piping following procedures of the manufacturer and/or the authority having jurisdiction.

END OF SECTION

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1 General

1.1 SECTION INCLUDES

.1 Materials, equipment selection, installation and start up for hydronic system pumps.

1.2 RELATED SECTIONS

.1 Division 01 - General Requirements.

1.3 REFERENCES

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE).
  .1 Standard 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings.
.2 Electrical Equipment Manufacturers Advisory Council (EEMAC).
.3 Canadian Standards Association (CSA International).
  .1 CAN/CSA-B214, Installation Code for Hydronic Heating Systems.
.4 National Electrical Manufacturers Association (NEMA).
  .1 NEMA MG 1, Motors and Generators.
.5 National Research Council of Canada:
  .1 National Energy Code of Canada 2020.

1.4 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
.3 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.
.4 Submit product data of pump curves for review showing point of operation. Including rated capacities, NPSHR, efficiency lined and BHP lines.
.5 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.
.6 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.5 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse in accordance Division 01 - General Requirements.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
.4 Separate for reuse and place in designated containers Steel waste in accordance with Waste Management Plan.
.5 Fold up metal banding, flatten and place in designated area for recycling.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Division 01 - General Requirements.
.2 Furnish following spare parts:
  .1 Mechanical seal for each pump.
  .2 Packing for each pump.
  .3 Set of gaskets for each pump.

2 Products

2.1 EQUIPMENT

.1 Do component selection and sizing to: CAN/CSA-B214.
.2 When pump name plate is greater than 7.5 kW (10 HP) pump must be variable speed.

2.2 IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with screwed or flanged design suction and discharge connections.
.2 Impeller: cast bronze, cast iron or stainless steel to suit application.
.3 Shaft: stainless steel with bronze sleeve bearing, integral thrust collar.
.4 Seal assembly: mechanical for service to 135 degrees C.
.5 Motor: as per Section 23 05 13 - Common Motor Requirements for HVAC Equipment and as per manufacturer's recommendations. Speed and power as indicated.
.6 Capacity: as indicated.
.7 Design pressure: 1200 kPa.
.8 Acceptable Material: Bell & Gossett, Taco, Armstrong, Grundfos, Wilo.

2.3 IN-LINE WET ROTOR CIRCULATORS

.1 Pump body: Cast iron
.2 Impellor: Polypropylene (glass filled)
.3 Shaft: Stainless steel
.4 Bearings: Graphite
.5 Gasket material: EPDM
.6 Maximum fluid temperature: 110ºC
.7 Maximum working pressure: 1000 kPa
.8 Capacity: as indicated.
.9 Connections: union or flanged
.10 Acceptable Material: Bell & Gossett, Taco, Armstrong, Grundfos, Wilo.

2.4 VERTICAL IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with tapped openings for venting, draining and gauge connections, with screwed or flanged suction and discharge connections.
.2 Impeller: bronze or stainless steel, dynamically balanced.
.3 Shaft: stainless steel with bronze sleeve bearing, integral thrust collar.
.4 Seal assembly: mechanical for service to 135 degrees C.
.5 Motor: to NEMA MG 1 resilient mounted, drip proof, sleeve bearing, maximum 1750 r/min.
.6 Capacity: as indicated.
.7 Design pressure: 1200 kPa.
.8 Acceptable Material: Bell & Gossett, Taco, Armstrong, Grundfos, Wilo.

2.5 VARIABLE-SPEED CLOSE-COUPLED VERTICAL IN-LINE PUMPS

.1 General: Single-stage, close-coupled, vertical in-line centrifugal pump with suction and discharge connections complete with motor and factory-mounted integral variable-frequency drive.
.2 Performance: Capacity, head, motor power, voltage, phase, and maximum speed shall be as indicated. Select pump so the scheduled duty point is within the manufacturer’s preferred operating region and the motor is not overloaded throughout the operating range or limited by the VFD protections.
.3 Construction: Cast-iron casing with flanged connections, stainless-steel or bronze impeller and stainless steel shaft or stainless steel shaft sleeve, and replaceable mechanical seal suitable for the specified inhibited propylene-glycol solution and system operating conditions. Provide vent, drain, and suction and discharge pressure-tapping connections.

.4 Motor: NEMA Premium-efficiency, inverter-duty motor with shaft grounding rings suitable for continuous variable-speed operation. Motor enclosure shall be totally enclosed fan-cooled unless otherwise indicated.
.5 Integral variable-frequency drive: Factory mounted, wired, programmed, and tested as part of the pump assembly. Provide local fused disconnect, vibration isolation, local display, adjustable minimum and maximum speeds, motor protection, and automatic restart following restoration of power.
.6 Control: Pump speed shall be controlled by the building automation system through the integral variable-frequency drive.
.7 Building automation interface: Provide native BACnet communication and hardwired terminals for remote enable, running status, and common alarm. Make pump speed, drive output, power, operating status, and fault code available to the building automation system. Coordinate with Division 25.
.8 Acceptable Material: Bell & Gossett, Armstrong, Grundfos, Taco, or Wilo.

3 Execution

3.1 INSTALLATION

.1 Do Work in accordance with CAN/CSA-B214.
.2 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible.
.3 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.
.4 Pipe drain tapping to floor drain.
.5 Check rotation prior to start-up.
.6 Install pressure gauge ball valves.

3.2 START-UP

.1 General
  .1 In accordance with Division 01 - General Requirements; supplemented as specified herein.
  .2 In accordance with manufacturer's recommendations.
.2 Procedures:
  .1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.
  .2 After starting pump, check for proper, safe operation.
  .3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
  .4 Check base for free-floating, no obstructions under base.
  .5 Run-in pumps for 12 continuous hours.
  .6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.
  .7 Eliminate air from scroll casing.
  .8 Adjust water flow rate through water-cooled bearings.
  .9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.
  .10 Adjust alignment of piping and conduit to ensure true flexibility at all times.
  .11 Eliminate cavitation, flashing and air entrainment.
  .12 Adjust pump shaft seals, stuffing boxes, glands.
  .13 Measure pressure drop across strainer when clean and with flow rates as finally set.
  .14 Replace seals if pump used to degrease system or if pump used for temporary heat.
  .15 Verify lubricating oil levels.
  .16 Verify pipe system has been flushed , cleaned and filled.
  .17 Prime pump and verify correct rotation.
  .18 Verify correctly sized motor overload devices are installed.

.19 Ensure strainer is free of debris prior to testing and balancing of the hydronic system.
.20 After 30 days of operation, perform a final cleaning of the strainers.

3.3 PERFORMANCE VERIFICATION (PV)

.1 General
  .1 In accordance with Division 01 - General Requirements, supplemented as specified herein.
  .2 In accordance with manufacturer's recommendations
.2 Assumptions: these PV procedures assume that:
  .1 Manufacturer's performance curves are accurate.
  .2 Valves on pump suction and discharge provide tight shut-off.
.3 Net Positive Suction Head (NPSH):
  .1 Application: measure NPSH for pumps which operate on open systems and with water at elevated temperatures.
  .2 Measure using procedures prescribed in the Standard.
  .3 Where procedures do not exist, discontinue PV, report to Consultant and await instructions.
.4 Multiple Pump Installations - Series and Parallel:
  .1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.
.5 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.
.6 Commissioning Reports: In accordance with Division 01 - General Requirements, supplemented as specified herein. Reports to include:
  .1 Record of point(s) of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.
  .2 Report forms as specified Division 01 - General Requirements.
  .3 Pump performance curves (family of curves).

3.4 FIELD QUALITY CONTROL

.1 Commissioning:
  .1 Manufacturer to:
    .1 Certify installation.
    .2 Start up and commission installation per tests recommended by manufacturer under actual or simulated operating conditions, and provide full compliance with design and specified requirements. Tests to be performed simultaneously with the system of which each item is an integral part.
    .3 Demonstrate operation and maintenance.
  .2 Provide Consultant at least 24 hours notice prior to inspections, tests and demonstrations. Submit written report of inspections and test results.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 The Contractor shall provide and install a complete submersible type well pump including intake strainer, pump bowl assembly, column, surface pedestal and submersible electric motor.

1.2 RELATED SECTIONS

.1 Section 33 21 14 - Water Supply Wells

1.3 REFERENCES

.1 National Electrical Manufacturers Association (NEMA)
.2 ANSI B16.5-88, Pipe Flanges and Flanged Fittings; Addenda B16.5A-92.
.3 National Energy Code of Canada 2020.

2 Products

2.1 OPERATING CONDITIONS

.1 Final pump selection shall be provided only after receipt of well pump test report (by others). The following is provided for estimating purposes only.
.2 Each well pump specified has the following preliminary estimated requirements:
  .1 Well total depth = 150 ft (estimated).
  .2 Total pump head = 325 ft (estimated).
  .3 Expected well water temperature = 50°F.
  .4 Expected operating flow = 62 USgpm.
  .5 Estimated distance from wellhead to starter for both well pumps = 300 ft.
  .6 Operating voltage 208/3ph/60Hz.
.3 All pumps shall be variable speed.

2.2 MATERIALS

.1 Motor
  .1 The submersible electric motor shall conform to the latest National Electrical Manufacturers Association (NEMA) specifications for submersible motors. The motor thrust bearing shall be sized to carry the weight of all rotating parts plus the hydraulic thrust of the motor regardless of the direction of rotation.
  .2 The motor shall be of squirrel cage induction type, suitable for across the line starting and continuous operation in 45°F water. The output shaft, fasteners, and wetted motor components shall be 316 or 904L stainless steel, suitable for the pumped liquid.
.2 Pump/Motor Coupling
  .1 The coupling shall be of 316 or 904L stainless steel and shall be capable of transmitting the total torque of the unit, regardless of the direction of rotation.
.3 Inter-connector
  .1 The inter-connector shall be constructed of 316 or 904L stainless steel and shall connect the motor and bowl unit. It shall incorporate a bronze bearing with a length to shaft ratio of at least 3:1. This bearing shall be protected from sand by a labyrinth type sand slinger. The inter-connector shall include a suction screen which has a net open area of at least 4 times the eye of the impeller. The screen shall be made of 316 or 904L stainless steel.
.4 Pump
  .1 The pump supplied under this specification shall be of the multi stage turbine type. It shall be fitted with a stainless steel (316 or 904L) shaft. Impellers shall be of 316 or

904L stainless steel.. Bowls (impeller housings) shall be of 316 or 904L stainless steel with allowances for replacement of the wear rings. Bowls shall include sufficient clearance for impeller movement resulting from the combination of thermal expansion, dead weight and hydraulic thrust.

.2 Impellers shall be securely fastened to the shaft using stainless steel split bushings, reverse threaded, or keyed to shaft. Impellers shall be adjustable vertically by an external means.

.3 The pump shall be designed for continuous operation in 45°F water with salt water resistance as determined following the well water test. Pump shall be selected for a minimum efficiency of 50% at the design flow rate.

.5 Surface Plate

.1 The base plate shall be constructed of carbon steel plate of a minimum 1" thickness and shall rigidly support the weight of the motor, column pipe, pump, cable bowl assembly and column of water. It shall be equipped with an ANSI B16.5, 150 lb flanged connection for the production flow connection to the system.

.6 Column

.1 The column pipe shall be schedule 40 steel galvanized pipe from pump to pitless adapter. Remaining pipe from pitless adapter to mechanical room shall be SDR 11 polypipe.

.7 Submersible Cable

.1 The cable shall be sized to limit the voltage drop to less than 2% at the motor terminals. Three separate conductors shall be furnished. The conductor insulation shall be water and oil resistant and suitable for continuous immersion.

.2 The length of the cable to be furnished shall be the sum of the pump setting depth, including the bowl assembly, plus one foot for each 50 feet of setting, plus the distance from the well head to the pump panel or junction box. The cable will be suitably supported from the pump column.

3 Execution

3.1 EXECUTION

.1 Install as per manufacturer's recommendations and in accordance with all authorities having jurisdiction.

.2 Provide all permits, fees, inspections, etc. required for the work of this Section.

.3 Provide startup, prefunctional checks and verifications, in accordance with commissioning documentation and manufacturer's recommednations.

.4 Install permanent pump in the well at a minimum depth of 8M (25ft) below the maximum draw down ground water level.

.5 Perform disinfection of well, as per provincial regulations.

.6 Perform biological and chemical testing of water per provinical regulations.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 RELATED SECTIONS

.1 Division 01 - General Requirements.
.2 Section 07 84 00 - Firestopping.
.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
.4 Section 23 05 94 - Pressure Testing of Ducted Air Systems.
.5 Section 23 40 00 - HVAC Filteration

1.3 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  .2 ASTM A635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
  .3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Safety Data Sheets (SDS).
.4 National Fire Protection Association (NFPA).
  .1 NFPA 90A, Standard for the installation of Air-Conditioning and Ventilation Systems.
  .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
  .3 NFPA 96, Standard for ventilation control and fire protection of commercial cooling operations.
.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition and Addendum No. 1.
  .2 SMACNA HVAC Air Duct Leakage Test Manual, 1st Edition.
  .3 IAQ Guideline for Occupied Buildings Under Construction, 1st Edition.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
.2 Product Data: submit WHMIS SDS - Safety Data Sheets for the following:
  .1 Sealants.
  .2 Tape
  .3 Proprietary Joints.

1.5 QUALITY ASSURANCE

.1 Certification of Ratings:
  .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
.2 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

.3 Indoor Air Quality (IAQ) Management Plan.
  .1 Develop and implement an Indoor Air Quality (IAQ) Management Plan for construction and preoccupancy phases of building.
  .2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.
.4 Installers to be certified journey person level in sheet metal works.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.
.2 Waste Management and Disposal:
  .1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
  .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  .3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  .4 Separate for reuse and place in designated containers Steel waste in accordance with Waste Management Plan.
  .5 Place materials defined as hazardous or toxic in designated containers.
  .6 Handle and dispose of hazardous materials in accordance with Provincial regulations.
  .7 Fold up metal banding, flatten and place in designated area for recycling.

2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

MAX Pressure Pa	SMACNA Seal Class
1000	A
750	B
500	C
250	C
125	C

.2 Seal classification:
  .1 Class A: longitudinal seams, transverse joints, duct wall penetrations, and connections made air tight with sealant and tape.
  .2 Class B: Longitudinal seam transverse joints, and connections made air tight with sealant, type or combination thereof.
  .3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.
.2 Tape sealing shall not be used as the primary sealant.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual and Section 23 05 94 - Pressure Testing of Ducted Air Systems.
.2 Maximum leakage rate shall be per the National Energy Code of Canada, 5.2.24..

2.5 FITTINGS

.1 Fabrication: to SMACNA.
.2 Radiused elbows.
  .1 Rectangular: centreline radius: 1.5 times width of duct.
  .2 Round: smooth radius or five piece. Centreline radius: 1.5 times diameter.
.3 Mitred elbows, rectangular:
  .1 To 400 mm: with single thickness turning vanes.
  .2 Over 400 mm: with double thickness turning vanes.
.4 Branches:
  .1 Rectangular main and branch: with radius on branch 1.5 times width of duct or 45 degree entry on branch.
  .2 Round main and branch: enter main duct at 45 degrees with conical connection.
  .3 Provide volume control damper in branch duct near connection to main duct.
  .4 Main duct branches: with splitter damper.
.5 Transitions:
  .1 Diverging: 20 degrees maximum included angle.
  .2 Converging: 30 degrees maximum included angle.
.6 Offsets:
  .1 Full radiused elbows.
.7 Obstruction deflectors: maintain full cross-sectional area.
  .1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Firestopping.
.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
.2 Thickness, fabrication and reinforcement: to SMACNA.
.3 Joints: to SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.8 STAINLESS STEEL

.1 To ASTM A480/A480M, Type 304. Except in swimming pools where material shall be type 316.
.2 Finish: No 4. finish on exposed side of duct in finished areas. No. 3 finish or lower where concealed.
.3 Thickness, fabrication and reinforcement: to SMACNA.
.4 Joints: to SMACNA and be continuous inert gas welded.

2.9 ALUMINUM

.1 To SMACNA, Aluminum type: 3003-H-14.
.2 Thickness, fabrication and reinforcement: to SMACNA.
.3 Joints: to SMACNA and be continuous weld.

2.10 BLACK STEEL

.1 To ASTM A635/A635M.
.2 Thickness: 1.2 mm.
.3 Fabrication: ducts and fittings or SMACNA.
.4 Reinforcement: to SMACNA.
.5 Joints: continuous weld.

2.11 KITCHEN EXHAUST SYSTEMS

.1 Construct in accordance with NFPA 96.
.2 Material: Type 304 stainless steel where exposed, stainless steel where concealed or black sheet where concealed.
.3 Thickness: to NFPA 96.
.4 Fabrication: joints, continuous inert gas welded for stainless steel, ARC welded for black steel.
.5 Reinforcement: to SMACNA.
.6 Drainage: at low point.
.7 Grease filters: to Section 23 44 00 - HVAC Air Filtration.

2.12 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
    .1 Maximum size duct supported by strap hanger: 500.
    .2 Hanger configuration: to ASHRAE.
    .3 Hangers: black steel angle with black steel rods to ASHRAE:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2410 and over	50 x 50 x 6	10

    .4 Upper hanger attachments:
      .1 For concrete: manufactured concrete inserts.
      .2 For steel joist: manufactured joist clamp.
      .3 For steel beams: manufactured beam clamps.
      .4 Acceptable material: Myatt, Grinnel, Hunt.

3 Execution

3.1 GENERAL

.1 Do work in accordance with, NFPA 90A & 90B, ASHRAE and SMACNA.
.2 Do not break continuity of insulation vapour barrier with hangers or rods.
  .1 Insulate strap hangers 100 mm beyond insulated duct.
.3 Support risers in accordance with SMACNA.
.4 Install breakaway joints in ductwork on sides of fire separation. Do not place fire stopping material in expansion space between damper sleeve and fire partition.
.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.
.2 Angle hangers: complete with locking nuts and washers.
.3 Hanger spacing: in accordance with SMACNA

Duct Size (mm)	Spacing (mm)
to 1500	3000

Duct Size (mm)	Spacing (mm)
1501 and over	2500

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:
  .1 Dishwasher exhaust.
  .2 Fresh air intake.
  .3 Minimum 3000 mm from duct mounted humidifier in all directions.
  .4 As indicated.
.2 Form bottom of horizontal duct without longitudinal seams.
  .1 Solder joints of bottom and side sheets.
  .2 Seal other joints with duct sealer.
.3 Slope horizontal branch ductwork down towards fume hoods served.
  .1 Slope header ducts down toward risers.
.4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve and discharging to open funnel drain.

3.4 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.
.2 Bed tape in sealant and recoat with minimum of one (1) coat of sealant to manufacturer's recommendations. Sealant and tape to be applied to full perimter of duct.

3.5 KITCHEN EXHAUST SYSTEMS

.1 Install NFPA 96 and as indicated.

3.6 LEAKAGE TESTS AND COMMISSIONING

.1 Refer to Section 23 05 94 - Pressure testing of ducted air systems.
.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
.3 Do leakage test in sections.
.4 Make trial leakage tests as instructed to demonstrate workmanship.
.5 Install no additional ductwork until trial test has been passed.
.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degree elbows.
.7 Complete test before insulation or concealment.

END OF SECTION

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1 General

1.1 GENERAL

.1 Refer to General, and Special Conditions for other requirements included and outlined in other sections of the specifications.

1.2 SCOPE OF WORK

.1 Provide all labour, materials, facilities, equipment and services to thoroughly clean the ductwork and fans for the supply air systems and all the related exhaust air systems installed or modified in this contract.

.2 The cleaning work shall include but not be limited to the following:
- .1 All existing supply and Return ductwork serving renovated area.
- .2 New ductwork installed in this Contract.
- .3 All reheat boxes, Grilles and Diffusers.

.3 Provide all labour and services to obtain access to HVAC Systems and associated components including removal of ceiling tiles.

.4 Replace or repair any damage to mechanical components, ceilings or walls caused during the duct cleaning.

.5 Scope of work to include the following:
- .1 Carry out field inspection and review to determine the method of cleaning the HVAC systems and its components. Submit to the Consultant, the proposed methods for cleaning and their efforts to the system.
- .2 Reset all balancing dampers to original settings if moved during cleaning. Be sure to mark original position so that during the final inspections original settings can be field verified.
- .3 Report to the Consultant, any system defects discovered during the cleaning operation which will require to an HVAC System (e.g., equipment, ductwork, dampers, registers, etc.).

1.3 SUBMITTAL PROCEDURES

.1 Pre-Construction:
- .1 Record of existing conditions.
- .2 Coordination plan.
- .3 NADCA Firm Registration Number and expiration date.
- .4 NADCA Air Cleaning Specialist (ASCE) Records
- .5 NADCA Team Assistants.
- .6 NADCA Supervisor and Qualifications.
- .7 Records of experience in the field of HVAC System Cleaning in compariable environments.
- .8 Work execution schedule.
- .9 Infection control plan to CSA Z317.13.
- .10 Infection control training records.
- .11 Cleaning procedures.

.2 Product Data:
- .1 Safety data sheets.

.3 Test Reports:
- .1 Testing procedure summary.
- .2 Gravametric analysis.
- .3 Post project report..

1.4 QUALITY ASSURANCE

.1 Ductwork shall be cleaned in compliance with mechanical cleaning of Non-Porous Air Conveyance System Components NADCA ACSC, NADCA ACR, NADCA HVAC Inspection Manual.

.2 All duct and fan system surfaces must be visibly clean and capable of passing the NADCA vacuum test. The weight of debris collected by the NADCA Vacuum Test shall not exceed 1.0 mg/100cm2.

2 Products

2.1 NOT APPLICABLE.

.1 Not Applicable.

3 Execution

3.1 PRE-CLEANING PREPARATIONS

.1 Prior to start of work, the HVAC system is to be carefully inspected and checked for all conditions affecting the cleaning. Defects are to be reported in writing to the Consutlant and work will not proceed until defects have been documented.

.2 Fire protection devices such as smoke detectors, etc. shall be protected prior to cleaning procedures.

.3 The Contractor shall have samples collected by gathering the gross debris from the surface of the duct at a minimum of three (3) locations per system prior to and after cleaning. This shall be accomplished by utilizing protective clean surgical gloves to handle the surface debris. A 100 cm2 area shall be scraped and the debris placed in a 4 oz. sterile container with screw cap. The container shall be adequately marked as to sample location, date and time. The total weight will be established per 100 cm2.

.4 Site Evaluation and Preparations:

.1 Conduct work without neagatively impacting the indoor environment. In cases where contamination is suspected, or in senstive environements, implement environmental infection control measures.

.2 Conduct site visits and prepare a site specific coordination plan which details how each area of the building is protected during the various phases of work.

3.2 CLEANING AND REMOVAL METHOD

.1 The following general ductwork cleaning procedures are to be used as a guideline. Determine which method should be used in each area and submit detailed description of the procedures to the Consultant.

.2 Debris Collection Equipment:

.1 Equipment used shall be portable and sized to enter the areas easily. Electrical requirements shall be the responsibility of the cleaning Contractor.

.2 The collection system shall be self-contained units, with the appropriate components to adequately collect dirt and debris loosened from the ductwork. Air duct cleaning is to be performed by a high powered vacuum system with three stages of filtration. The final stage to be a HEPA filter.

.3 The collection system shall be capable of producing a minimum of 0.42" water gauge negative static pressure and 0.25" water gauge velocity pressure in the area of ductwork to be cleaned.

.3 Agitation Equipment:

.1 Air power cleaning of all interior ductwork, fan housings and HVAC units performed by a high pressure compressed air system which will be directed through small access doors in the ductwork. The size and the number of access doors required for cleaning shall be determined by this Section and the access doors shall be as per Section 23 33 00 - Air Duct Accessories.

.2 Air powered lances, extended whip sections or oscillating brush systems shall be used as a means of dislodging the debris.
.3 Where ductwork is large enough and able to support the weight of a worker, hand tools and vacuum may be used. If workers enter the inside of the duct they must follow the OSHA confined space requirements.
.4 Open Ductwork: During the cleaning process, provide temporary closure of metal or taped polyethylene on open ductwork to prevent the dust during the cleaning process from dispersing throughout the work area.
.5 Debris removed during the cleaning process shall be collected and tagged as to its origin within the duct system.
.6 Coils shall be vacuumed such that they are visibly clean. Coil drain pans shall be subject to cleaning as per NADCA standards.
.7 Volume and Fire Dampers: Duct mounted volume and fire dampers are to be marked to their current settings and cleaned if necessary.

3.3 VERIFICATION

.1 General verification of cleanliness will be determined after the completion of cleaning process.
.2 All duct and air handling unit surfaces must be visibly clean and capable of passing the NADCA vacuum test.
.3 The weight of debris collected by the NADCA vacuum test shall not exceed 1.0 mg/100cm2.
.4 The contractor shall include the cost of four (4) vacuum tests per air handling system to be performed at the time and location as directed by the Consultant. If any areas fail, the system of the failed test shall be recleaned and retested at no cost to the Owner.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)
  .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Safety Data Sheets (SDS).

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
.2 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.
  .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .2 Instructions: submit manufacturer's installation instructions.
    .1 Consultant will make available 1 copy of systems supplier's installation instructions.

2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
.3 Locking quadrant with shaft extension to accommodate insulation thickness.
.4 Inside and outside nylon end bearings.
.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.
.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
  .1 Frame: minimum 16 Ga galvanized steel hat channel with mitered and welded corners. Provide 0.10 in thick aluminum hot channel frame for manual volume dampers installed in aluminum ductwork.
.3 Blades: Roll formed, 18 Ga galvanized steel, 4 inch maximum blade width. Provide roll-formed, 0.10 inch thick aluminum blade for manual volume dampers installed in aluminum ductwork, maximum 4 inch blade width.
.4 Blade Axles:
  .1 1/2" diameter square or hex plated steel.
  .2 1/2" diameter square or hex type 316 stainless steel axles for manual volume dampers installed in aluminum ductwork.

.5 Control Rod:
  .1 1/2" diameter plated steel or 3/8" square plated steel. Control rod located out of the airstream.
  .2 1/2" diameter or 3/8" square type 316 stainless steel control rod for manual volume dampers installed in aluminum ductwork. Control rod located out of the airstream.
.6 Bearings: Nylon, molded synthetic, or self-lubricating porous bronze.
.7 Finish: Mill.
.8 Performance: Designed for maximum pressure differential of 2" s.p. for 48", maximum temperature of 150 deg F, and maximum system velocity of 2,000 feet per minute.
.9 Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32 inch (2.4 mm) thick zinc-plated steel, and a 3/4 inch (19 mm) hexagon locking nut. Include center hole to suit damper operating rod size. Include elevated platform for insulated duct mounting.
.10 Jackshaft: 1 inch (25 mm) diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multi-damper assemblies.
  .1 Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
.11 Acceptable material: Ruskin MD-35/OB, Greenheck, MBD-15, Ventex, TAMCO, EH Price CLD-GV5-3V-MBD.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.
.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
.5 Dampers: vibration free.
.6 Ensure damper operators are observable and accessible.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.2 SUMMARY

.1 Section Includes:
  .1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
  .2 Indicate the following:
    .1 Performance data.
.2 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.
  .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .2 Instructions: submit manufacturer's installation instructions.
    .1 Consultant will make available 1 copy of systems supplier's installation instructions.
.3 Closeout Submittals
  .1 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements.

2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed blade or parallel blade type as indicated.
.2 Control Dampers:
  .1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 2438 mm high. Multiple sections to have stiffening mullions and jack shafts.
  .2 Materials:
    .1 Frame: 2.3 mm minimum thickness galvanized steel or extruded aluminum.
    .2 Blades: structurally formed galvanized steel with two (2) sheets 0.5 mm thick or extruded aluminum, otherwise reinforced to ensure specified low leakage when fully closed.
    .3 Bearings: oil impregnated sintered bronze. Provide thrust bearings for vertical blades.
    .4 Linkage and shafts: zinc plated steel.
    .5 Seals: replaceable neoprene or stainless steel spring on sides, top, bottom of frame, along all blade edges and blade ends.
  .3 Performance:
    .1 Capacity: refer to specifications.

.2 Leakage: in closed position, less than 2% of rated air flow at 250 Pa, differential across the damper.
.3 Pressure drop: at full open position less than 20 Pa differential across the damper at 7.62 m/s.
.4 Temperature range: -50°C to +100°C.
.5 Arrangements: damper mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.

.3 Operator: by control contractor. See applicable control section.
.4 Insulated aluminum dampers:
.1 Frames: insulated with extruded polystyrene foam with RSI 5.
.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 5.
.5 Acceptable material: Tamco, Ventex, EH Price, Greenheck or equal.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A653/A653M.
.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A653/A653M.
.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.
.4 Bearings: roller self lubricated and sealed.
.5 Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.
.6 Performance:
.1 Leakage: in closed position less than 2% of rated air flow at 500 kPa pressure differential across damper.
.2 Pressure drop: at full open position less than 25 kPa differential across damper at 10 m/s.

2.3 BACK DRAFT DAMPERS

.1 Suitable for horizontal or vertical mounting.
.2 Maximum Air Velocity: 1500 fpm (8 m/s).
.3 Maximum System Pressure: 2 inch wg (0.5 kPa).
.4 Frame of barometric relief damper shall match the mating duct system or equipment as follows: 0.064 inch (1.6 mm) thick, galvanized sheet steel or 0.063 inch (1.6 mm) thick extruded aluminums, with welded corners and mounting flange.
.5 Blades:
.1 Multiple, 0.050 inch (1.2 mm) thick aluminum sheet.
.2 Maximum Width: 6 inches (150 mm)l
.3 Action: Parallel.
.4 Balance: Gravity.
.5 Eccentrically pivoted.
.6 Blade Seals: Neoprene.
.7 Blade Axles: Galvanized steel.
.8 Tie Bars and Brackets
.1 Material: Aluminum
.2 Rattle free with 90 degree stop.
.9 Return Spring: Adjustable tension.
.10 Bearings: Synthetic.
.11 Accessories:
.1 Flange on intake.
.2 Adjustment device to permit setting for vary differential static pressures.

2.4 RELIEF DAMPERS

.1 Description: Gravity balanced.

.2 Maximum Air Velocity: 1500 fpm (8 m/s).
.3 Maximum Temperature: 150 deg F.
.4 Maximum System Pressure: 2 inch wg (0.5 kPa).
.5 Frame of the pressure relief/intake damper shall match the mating duct system or equipment as follows: 0.074 inch (19 mm) thick, galvanized sheet steel or 0.080 inch (2.03 mm) thick extruded aluminum or 0.074 inch (1.9 mm) thick stainless steel, with welded corners and mounting flange.
.6 Blades: Multiple single-piece blades, center-pivoted maximum 6 inch (150 mm) width, 0.060 inch (1.52 mm) thick galvanized steel sheets with V formed reinforcement or 0.063 inch (1.6 mm) thick extruded aluminum sheets, airfoil shaped.
.7 Blade Action: Parallel.
.8 Blade Seals: Neoprene, mechanically locked.
.9 Blade Axles:
    .1 Material: Plated steel.
    .2 Diameter: 0.50 inch (12.7 mm).
.10 Tie Bars and Brackets: Plated steel.
.11 Return Spring: Adjustable tension.
.12 Bearings: Steel ball or synthetic pivot bushings.
.13 Accessories:
    .1 Adjustment device to permit setting for varying differential static pressure.
    .2 Counterweights (on for every five blades) and spring-assist kits for vertical airflow installations.
    .3 Electric actuator.
    .4 Chain pulls.
    .5 Screen Mounting: Front mounted in sleeve.
        .1 Sleeve Thickness: 20 gage (1.0 mm) minimum.
        .2 Sleeve Length: 6 inches (152 mm) minimum.
    .6 Screen Mounting: Rear mounted.
    .7 Screen Material shall match the mating duct system: Galvanized steel, Stainless steel or Aluminum.
    .8 Screen Type: Insect.
    .9 90 degree stops.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.
.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
.3 Seal multiple damper modules with silicon sealant.
.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
.5 Ensure dampers are observable and accessible.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Fire and smoke dampers, and fire stop flaps.

1.2 RELATED SECTIONS

.1 Section 23 31 13 - Metal Ducts Low Pressure.

1.3 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
  .1 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).
.3 Underwriters Laboratories of Canada (ULC)
  .1 CAN4-S112, Fire Test of Fire Damper Assemblies.
  .2 CAN4-S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
  .3 ULC-S505, Fusible Links for Fire Protection Service.

1.4 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
  .2 Indicate the following:
    .1 Fire dampers.
    .2 Smoke dampers.
    .3 Fire stop flaps.
    .4 Operators.
    .5 Fusible links.
    .6 Design details of break-away joints.
.2 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.
  .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .2 Instructions: submit manufacturer's installation instructions.
.3 Closeout Submittals:
  .1 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.5 MAINTENANCE

.1 Extra Materials:
  .1 Provide maintenance materials in accordance with Division 01 - General Requirements.
.2 Provide following:
  .1 2 fusible links of each type.

2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type B or C, blades out of Air Stream, listed and bear the label of UL/ULC, meet requirements of ANSI/NFPA 90A and provincial fire authority. Fire damper assemblies fire tested in accordance with CAN4-S112. Type A dampers will not be accepted.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

- .1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.
- .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.3 Top hinged: offset single damper, round or square; multi-blade hinged, interlocking type; roll door type or guillotine type; sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.

.7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.

.10 Unless otherwise indicated, the installation details given in SMACNA fire, smoke and radiation damper installation guide for HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 FIRE STOP FLAPS

.1 Fire smoke flaps: ULC listed and labelled and fire tested in accordance with CAN4-S112.2.

.2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.

.3 Flaps held open with fusible link conforming to ULC-S505 and close at 74 degrees C.

2.3 SMOKE DAMPERS

.1 To be ULC or UL listed and labelled.

.2 Normally closed reverse action smoke vent (S/D-RASV): folding blade type, opening by gravity upon detection of smoke, and/or from remote alarm signalling device actuated by an electro thermal link. Two flexible stainless steel blade edge seals to provide required constant sealing pressure.

.3 Normally open smoke/seal (S/D-SSSD): folding blade type, closing when actuated by means of electro thermal link and/or from remote alarm signalling device. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units mounted horizontally in vertical ducts.

.4 Motorized (S/D-M): folding blade type, normally open with power on. When power is interrupted damper shall close automatically. Both damper and damper operator shall be ULC listed and labelled.

.5 Electro thermal link (S/D-ETL): dual responsive fusible link which melts when subjected to local heat of 74 deg C and from external electrical impulse of low power and short duration; ULC or UL listed and labelled.

2.4 COMBINATION FIRE AND SMOKE DAMPERS

.1 Damper: similar in all respects to smoke dampers specified above.
.2 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system from fusible link.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
.2 Maintain integrity of fire separation.
.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
.5 Co-ordinate with installer of firestopping.
.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
.7 Install break-away joints of approved design on each side of fire separation.

3.3 COMMISSIONING

.1 Commission in accordance with Division 01 - General Requirements.

END OF SECTION

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1 General

1.1 REFERENCES

.1 Air Conditioning and Mechanical Contractors (AMCA)
  .1 AMCA Publication 99, Standards Handbook.
  .2 AMCA 300, Reverberant Room Method for Sound Testing of Fans.
  .3 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  .1 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.4 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  .1 ASHRAE 51, laboratory methods of testing fans for aerodynamic performance rating.

.5 National Electric Manufacturers Association (NEMA)
  .1 NEMA MGI motors and generators.
  .2 NEMA ICS 7.1 safety standards for construction and guide for selection, installation and operation of adjustable drive systems.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:
  .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
  .2 Capacity: flow rate, total pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
  .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
  .4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.
  .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:
  .1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.

.3 Provide:
  .1 Fan performance curves showing point of operation, BHP and efficiency.
  .2 Sound rating data at point of operation.
  .3 Dimensional data.
  .4 Installation procedures.

.4 Indicate:
  .1 Motors, sheaves, bearings, shaft details.
  .2 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.

.5 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals:
.1 Provide operation and maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.4 MAINTENANCE

.1 Extra Materials:
.1 Provide maintenance materials in accordance with Division 01 - General Requirements.
.1 Spare parts to include:
.1 Matched sets of belts.
.2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
.1 Bearings and seals.
.2 Addresses of suppliers.
.3 List of specialized tools necessary for adjusting, repairing or replacing.
.4 Belts.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with Division 01 - General Requirements.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

2 Products

2.1 FANS GENERAL

.1 Capacity: Flow rate, static pressure, BHP, Efficiency, Revolutions per minute, power, model, size, sound power data, and as indicated on schedule.
.2 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
.3 Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.
.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANS/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.
.5 Motors:
.1 Open drip proof outside of air stream, TEFC when in air stream explosion proof as indicated in accordance with NEMA MG1.
.2 In accordance with Section 23 05 13 - Common Motor Requirements for HVAC Equipment supplemented as specified herein.
.3 For use with variable speed controllers.
.4 Sizes as indicated.
.5 Two speed with two windings and speeds 1200 or 900 r/min low and 1800 r/min high.
.6 Two speed with split winding, constant horsepower or constant or variable torque and speeds as indicated.
.6 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards, fan inlet or outlet safety screens as indicated and as specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment, inlet or outlet dampers and vanes and as indicated.
.7 Factory primed before assembly in colour standard to manufacturer.
.8 Scroll casing drains: as indicated.
.9 Finish on fume hood exhaust fans: heresite coated.

.10 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
.11 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
.12 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 CENTRIFUGAL FANS

.1 Fan wheels:
  .1 Welded steel or aluminum construction.
  .2 Maximum operating speed of centrifugal fans not more than 40 % of first critical speed.
  .3 Air foil blades, as indicated.
.2 Bearings: heavy duty grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.
.3 Shaft seals on laboratory fume hood exhaust fans:
  .1 Single disc or stuffing box seals.
.4 Housings:
  .1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, cast iron, steel, aluminum, for smaller wheels, braced, and with welded supports.
  .2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
  .3 Provide bolted airtight access doors with handles.
  .4 Spark resistant construction Type B minimum where indicated.
.5 Variable volume control devices:
  .1 Variable Speed Drives: to NEMA ICS 7.1 or as indicated in Controls and Instrumentation specifications.

2.3 CABINET FANS - GENERAL PURPOSE

.1 Fan characteristics and construction: as centrifugal fans.
.2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators and seismic control measures, motor, V-belt drive and guard casing.
.3 Fabricate casing of zinc coated or phosphate treated steel reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to CAN/CGSB 1.181. Finish inside and out, over prime coat, with rust resistant enamel. Internally line cabinet with 25 mm thick rigid acoustic insulation, pinned and cemented, complete with metal nosings on exposed edges.

2.4 UTILITY SETS

.1 Characteristics and construction: for centrifugal fans.
.2 Preassemble single width centrifugal fan with removable weatherproof protective hood with vents, and automatic spring loaded back draft dampers.
.3 Provide belt driven sets with adjustable motor bed plate and variable pitch driver sheave.

2.5 IN-LINE CENTRIFUGAL FANS

.1 Characteristics and construction: as for centrifugal fan wheels and direct or belt drive as indicated.
.2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
.2 Provide sheaves and belts required for final air balance.
.3 Bearings and extension tubes to be easily accessible.
.4 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

3.4 START-UP

.1 General:
  .1 Lubricate bearing and other motor parts with manufacturer's recommended lubricant.
  .2 Rotate impeller by hand and check for shifting during shipment.
  .3 Check all belts, collars, and other parts for tightness.
  .4 Clean fan interior to remove foreign material, construction dirt and dust.

3.5 PERFORMANCE VERIFICATION

.1 General
  .1 Verify operation of motor, drive system and fan wheel.
  .2 Check for vibration and correct if necessary after air balancing is complete.
  .3 Provide replacement pulleys and sheaves as required by air balancing Contractor.

3.6 FIELD QUALITY CONTROL

.1 Commissioning:
  .1 Manufacturer to:
    .1 Certify installation.
    .2 Start up and commission installation.
    .3 Carry out on-site performance verification tests.
    .4 Demonstrate operation and maintenance.
  .2 Provide Consultant at least 24 hours notice prior to inspections, tests and demonstrations. Submit written report of inspections and test results.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)
- .1 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .2 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.3 International Organization of Standardization (ISO)
- .1 ISO 3741, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.

.4 Underwriter's Laboratories (UL)
- .1 UL 181, Factory-Made Air Ducts and Air Connectors.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:
- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 01 - General Requirements.
- .2 Test data: to ANSI/AMCA 210.
  - .1 Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity.
  - .2 Sound power level with minimum inlet pressure of 0.25 kPa in accordance with ISO 3741 for 2nd through 7th octave band, also made by independent testing agency.
  - .3 Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.

.2 Shop Drawings:
- .1 Submit shop drawings in accordance with Division 01 - General Requirements.
- .2 Indicate the following:
  - .1 Capacity.
  - .2 Pressure drop.
  - .3 Noise rating.
  - .4 Leakage.
  - .5 Dimensions.

.3 Quality Assurance Submittals:
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle in accordance with Division 01 - General Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:
- .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance Division 01 - General Requirements.

1.6 MAINTENANCE

.1 Extra Materials:
- .1 Provide maintenance materials in accordance with Division 01 - General Requirements.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment include:
  - .1 Bearings and seals.
  - .2 Addresses of suppliers.
  - .3 List of specialized tools necessary for adjusting, repairing or replacing.

2 Products

2.1 MANUFACTURED UNITS

.1 Terminal units of the same type to be product of one manufacturer.

2.2 HEATING AND COOLING COILS

.1 Conform to ASTM B75 and AHRI 410.

.2 Tubes:
- .1 Minimum 16mm tube diameter; seamless copper tubing.

.3 Fins:
- .1 0.1397mm aluminum or 0.1143mm copper mechanical bonded or soldered or helically wound around tubing.

.4 Headers:
- .1 Copper, welded steel or cast iron. Provide seamless copper tubing or resistance welded steel tube for volatile refrigerant coils.

.5 "U" bends:
- .1 Where used: machine die-formed, silver brazed to tube ends.

.6 Coil Casing:
- .1 1.6mm galvanized steel with tube supports at 1200mm maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.

.7 Pressure kPa (PSIG):

Pressure	Water Coil	Steam Coil	Refrigerant Coil
Test	2070 (300)	1725 (250)	2070 (300)
Working	1380 (200)	520 (75)	1725 (250)

.8 Protection:

.1 Unless protected by the coil casing, provide cardboard, plywood or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.

.9 Vents and Drains:

.1 Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing.

.10 Cooling Coil Condensate Drain Pan: Drain pan shall be designed to be extend entire length of cooling coils including headers and return bends. Depth of drain pan shall beat least 43mm and shall handle all condensate without overflowing. Drain pan shall be single-wall, sloping type and fabricated from stainless steel (304). Drain pan shall be continuous metal or welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be integrated into duct assembly. Drain pan shall be pitched in all directions to drain line.

.1 Drain pan shall be piped to the exterior of the unit. Drain pan shall be readily cleanable.

.2 Installation, including frame, shall be designed and sealed to prevent blow-by.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of ductwork.

.3 Install with at least 1000 mm of flexible inlet ducting and minimum of four duct diameters of straight inlet duct, same size as inlet.

.4 Locate controls, dampers and access panels for easy access.

3.3 CLEANING

.1 Proceed in accordance with Division 01 - General Requirements.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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1 General

1.1 SYSTEM DESCRIPTION

.1 Performance Requirements:
- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.2 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 01 - General Requirements.
  - .2 Indicate following:
    - .1 Capacity.
    - .2 Throw and terminal velocity.
    - .3 Noise criteria.
    - .4 Pressure drop.
    - .5 Neck velocity.

1.3 MAINTENANCE

.1 Extra Materials:
- .1 Provide maintenance materials in accordance with Division 01 - General Requirements.
- .2 Include:
  - .1 Keys for volume control adjustment.
  - .2 Keys for air flow pattern adjustment.

2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:
- .1 Full perimeter gaskets.
- .2 Plaster frames where set into plaster or gypsum board.
- .3 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: standard.

.5 Acceptable Material: E.H. Price, Titus, Nailor, Tuttle & Bailey.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS (REFER TO SCHEDULE)

.1 General: See Schedule.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS (REFER TO SCHEDULE)

.1 General: See Schedule.

2.5 DIFFUSERS (REFER TO SCHEDULE)

.1 General: See Schedule.

2.6 LINEAR GRILLES (REFER TO SCHEDULE)

.1 General: See Schedule.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturers instructions.
.2 Install with flat head screws in countersunk holes where fastenings are visible.
.3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
.4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms and elsewhere as indicated.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation for piping and fittings used in HVAC heat exchangers.

1.2 RELATED SECTIONS

.1 Section 02 61 00 - Hazardous Facility Remediation.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
  .1 ASME Boiler and Pressure Vessel Code.
    .1 BPVC-VIII B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 1.
    .2 BPVC-VIII-2 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.
    .3 BPVC-VIII-3 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 3 - Alternative Rules High Press Vessels.
.2 Canadian Standards Association (CSA International)
  .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Safety Data Sheets (SDS).
.4 Province of Prince Edward Island Boiler and Pressure Vessel Act and Regulations.

1.4 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet for heat exchangers.
  .2 Submit WHMIS SDS. Indicate VOC's for adhesive and solvents during application and curing.
.3 Shop Drawings:
  .1 Submit shop drawings to indicate project layout including layout, dimensions of heat exchangers and system. Indicate following information:
    .1 Manufacturer's recommended clearances for tube withdrawal and manipulation of tube cleaning tools.
    .2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
    .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
    .4 Instructions: submit manufacturer's installation instructions.
    .5 Manufacturer's Field Reports: manufacturer's field reports specified.
    .6 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Division 01 - General Requirements.

1.5 QUALITY ASSURANCE

.1 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.6 MAINTENANCE

.1 Maintenance Materials:
  .1 Provide maintenance materials in accordance with Division 01 - General Requirements.
.2 Supply following spare parts:
  .1 Head gaskets.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:
  .1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
  .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  .3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
  .4 Separate for reuse and place in designated containers Steel waste in accordance with Waste Management Plan (WMP).
  .5 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

2 Products

2.1 PLATE HEAT EXCHANGER

.1 General:
  .1 Water to water.
  .2 Designed, constructed and tested in with accordance ASME Boiler and Pressure Vessel Code, Section VIII, CSA B51 and provincial pressure vessel regulations.
.2 Frames: carbon steel with baked epoxy enamel paint, stainless steel side bolts and shroud.
.3 Plates: titanium.
.4 Gaskets: as recommended by manufacturer to suit fluid temperature.
.5 Nozzles: well water - titanium, building water - 316 stainless steel.
.6 Supports: as indicated.
.7 Piping connections: as indicated.
.8 Capacity: as indicated.
.9 Dimensions: as indicated.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 General: install level and firmly anchored to supports as indicated.
.2 Plate exchangers: install in accordance with manufacturer's recommendations.

3.3 APPURTENANCES

.1 Install with safety relief valve piped to drain.
.2 Install thermometer wells with thermometers on inlet and outlet of primary and secondary side.

3.4 FIELD QUALITY CONTROL

.1 Start-up:

.1 General: perform start-up operations in accordance with Section 01 91 13 - General Commissioning Requirements, supplemented as specified herein.
.2 Check heater for cleanliness on primary and secondary sides.
.3 Check water treatment system is complete, operational and correct treatment is being applied.
.4 Check installation, settings, operation of relief valves and safety valves.
.5 Check installation, location, settings and operation of operating, limit and safety controls.
.6 Check supports, seismic restraint systems.

.2 Performance Verification:
.1 General: perform performance verification in accordance with Section 01 91 13 - General Commissioning Requirements, supplemented as specified.
.2 Timing: only after TAB of hydronic systems have been successfully completed.
.3 Primary side:
.1 Measure flow rate, pressure drop, and either one steam pressure and temperature at heater inlet or two water temperature at heater inlet and outlet.
.2 Verify operation of steam traps. Measure temperature of condensate return at trap outlet.
.4 Control valve: verify proper operation without binding, slack in components. Measure either steam pressure and temperature at control valve inlet or two if control is three-port type, pressure drop across inlet to common, bypass to common, inlet to bypass.
.5 Secondary side:
.1 Measure flow rate, pressure drop and water temperature at heater inlet and outlet.
.2 Verify installation and operation of air elimination devices.
.6 Calculate heat transfer from primary and secondary sides.
.7 Simulate heating water temperature schedule and repeat above procedures.
.8 Verify settings, operation, safe discharge from safety valves and relief valves.
.9 Verify settings, operation of operating, limit and safety controls and alarms.
.10 Reports:
.1 In accordance with Section 01 91 13 - General Commissioning Requirements: Reports, supplemented as specified herein.

3.5 DEMONSTRATION

.1 Training: provide training in accordance with Section 01 91 13 - General Commissioning Requirements: Training of O&M Personnel, supplemented as specified.

3.6 CLEANING

.1 Perform cleaning operations as specified in Division 01 - General Requirements and in accordance with manufacturer's recommendations.
.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

.1 Air-Conditioning and Refrigeration Institute (ARI)
  .1 ARI 550/590, Water Chilling Packages Using the Vapor Compression Cycle.
.2 Canadian Standards Association (CSA International)
  .1 CSA B52, Mechanical Refrigeration Code.
.3 Environment Canada, (EC)/Environmental Protection Services (EPS)
  .1 EPS 1/RA/2, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.
.4 Prince Edward Island Boiler and Pressure Vessels Act Regulations.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.
.2 Indicate:
  .1 Equipment including connections, piping and fittings, valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.
  .2 Wiring as assembled and schematically.
  .3 Dimensions, construction details, recommended installation procedures and support, mounting bolt hole sizes and locations and point loads.
  .4 Type of refrigerant used.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in accordance with Division 01 - General Requirements.
.2 Data to include:
  .1 Description of equipment giving manufacturers name, type, model, year, capacity and serial numbers.
  .2 Provide part load performance curves.
  .3 Details on operation, servicing and maintenance.
  .4 Recommended spare parts list.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:
  .1 Separate waste materials for reuse and recycling in accordance with Division 01 - General Requirements.
  .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Owner's Representative.

1.6 EXTRA MATERIALS

.1 Furnish following spare parts: circuit board, relays, fuses, pilot lights, filters, solenoid hold coils, and thermal expansion valves. One of each type and size.

2 Part 2 Products

2.1 GENERAL

.1 Provide complete air or water cooled scroll type package as specified including: compressor; evaporator (liquid source); condenser (liquid cooled), motor and motor starter; controls; control centre; piping; wiring; refrigeration and oil change; ready for connection to chilled water circuit, condenser water circuit, interlocks, and electric power source, installed in welded steel frame with heavy gauge panels and access doors finished to manufacturers standard.

.2 Acceptable Manufacturers: Nordic, Water Furnace, Trane, ClimateMaster.

2.2 CAPACITY

.1 Certified ratings based on ARI 550:

- .1 Capacity: as indicated.
- .2 Water cooled condenser capacity: as indicated.
- .3 Air cooled condenser capacity: as indicated.
- .4 Power input, including electrical components: as indicated.
- .5 Fouling factor: 0.00025.
- .6 Refrigerant: R454b.

.2 Unit power input capable of operating with line voltage of 208 V,3 PH, 60 Hz.

2.3 COMPRESSOR

.1 Scroll design.

.2 Compressor to include suction and discharge shut-off valves; oil sight glass; separate circuit crankcase heater; internal oil filtration, internal pressure relief to suction, high oil temperature protection, loss of oil charge protection, low oil flow protection, suction inlet, screen, rubber in shear isolator mountings, full factory oil change.

.3 Provide nameplate to show capacity at design temperature, type of refrigerant used and total weight in system.

.4 Include 5 year warranty.

2.4 EVAPORATOR

.1 Dual circuited, direct expansion, brazed plate design. Evaporator to be designed, tested and stamped in accordance with ASME pressure vessel code for refrigerant side working pressures in compliance with CSA B52 and CSA B51. Heat exchanger is to be insulated with 20 mm thick flexible elastomeric insulation with RSI value of 0.53 m2 - 0C/W.

2.5 CONDENSOR

.1 Liquid cooled:

- .1 Brazed plate type, pressure relief device, purge and charge cock and liquid shut- off valve to CSA B52.
- .2 Water regulating valve: sensing condensing or head pressure to control water flow.

2.6 CONTROLS

.1 All controls, including sensors, are to be factory mounted and tested prior to shipment. Microcomputer controls to provide all control functions including start-up and shut down, leaving heating water temperature control, compressor and electronic expansion valve modulation, anti-cycle logic, automatic compressor starting, load limiting. The controller also to provide control outputs for the chilled water pump.

.2 Unit protective functions to include loss of chilled water flow, evaporator freezing, high and low refrigerant pressure, reverse rotation, compressor starting and running over current, phase loss, phase imbalance, phase reversal, and loss of oil flow.

.3 The controls package to include digital cycle counters and hour meters for each compressor, under/over voltage protection, remote alarm contacts, compressor run indication contacts, maximum capacity contacts, percent volts display, and a percent rated amps (each compressor) display.

.4 A menu driven, digital display to provide a full array of operating conditions and diagnostic readouts.

.5 Unit controls to include adaptive control technology to sense the unit control variables and take corrective action to keep the chiller running when any of the variables approach a limiting or alarm condition. Abnormal conditions include high/low temperatures and motor current overload. Should the abnormal condition continue until a protective limit is reached, the unit shall shut down.

.6 Single point power connection to unit complete with non-fused disconnect switch.

.1 Provide control circuit transformer as required.

.7 Provide control panel with a BACnet building automation system communication interface to permit bi-directional communications between chiller control panels and building EMCS for complete monitoring and control of all chiller features and parameters.

3 Execution

3.1 GENERAL

.1 Install unit as indicated, to manufacturer's recommendations, and in accordance with EPS 1/RA/2.

.2 Ensure adequate clearances for servicing and maintenance. In accordance with manufacturers recommendations.

.3 Provide seasonal start ups and shut downs during warranty period.

3.2 COMMISSIONING

.1 Manufacturer to approve installation, to supervise startup and to instruct operators. Refer to Section 01 91 13 - General Commissioning (Cx) Requirements.

.2 Final commissioning to take place between December and March when ambient temperature is at design conditions.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials, components and installation for heat reclaim devices.
.2 Related Sections:
  .1 Section 23 33 00 - Air Duct Accessories.
  .2 Section 23 33 15 - Dampers Operating.
  .3 Section 23 72 16 - Air Handling Unit - Backup.
  .4 Section 23 72 11 - Air Handling Unit - Packaged.

1.2 REFERENCES

.1 American Bearing Manufacturer's Association (ABMA)
  .1 ANSI/ABMA 9 Load Ratings and Fatigue Life for Ball Bearings.
  .2 ANSI/ABMA 11 Load Ratings and Fatigue Life for Roller Bearings.
.2 Air Movement and Control Association (AMCA)
  .1 AMCA 210, Laboratory Method of Testing Fans for Aerodynamic Performance Rating (ASHRAE).
  .2 AMCA 300 Reverberant Room Method for Second Testing of Fans.
.3 American National Standards Institute / Air-Conditioning. Heating and Refrigeration Institute (ANSI/ASHRI).
  .1 ANSI/AHRI 430, Central Station Air Handling Units.
  .2 ANSI/AHRI 1060, Performance Rating of Air-to-Air Heat Exchangers Energy Recovery Ventilation Equipment.
.4 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE).
  .1 ASHRAE 68, Laboratory Method of Testing to Determine the Sound Power in a Duct.
  .2 ASHRAE 84, Method of Testing Air-to-Air Exchangers.
.5 American Society for Testing and Materials (ASTM).
  .1 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
.6 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.
.7 Canadian Standards Association (CSA)
  .1 CSA B52 Mechanical Refrigeration Code.
.8 National Electrical Manufacturer's Association (NEMA)
  .1 NEMA MG1 Motors and Generators
  .2 NEMA ICS 7-1 Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive System.
.9 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.
.10 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 - General Requirements. Include product characteristics, performance criteria, and limitations.
    .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Division 01 - General Requirements.
.2 Shop Drawings:
  .1 Submit shop drawings in accordance with Division 01 - General Requirements.
    .1 Shop drawings: submit drawings stamped and signed by Contractor as reviewed.

.2 Indicate following: fan, fan curves showing points of operation, motor drive, bearings fillers, mixing box, dampers, VAV, coil, include performance data.

.3 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:
- .1 Provide operation and maintenance data for incorporation into manual specified in Division 01 - General Requirements.

.5 Certificates:
- .1 Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle in accordance with manufacturer's written instructions and Division 01 - General Requirements.

.2 Waste Management and Disposal:
- .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse in accordance with Division 01 - General Requirements.

1.6 MAINTENANCE

.1 Extra Materials:
- .1 Provide maintenance materials in accordance with Division 01 - General Requirements.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment include:
  - .1 Bearings and seals.
  - .2 Addresses of suppliers.
  - .3 List of specialized tools necessary for adjusting, repairing or replacing.

2 Products

2.1 GENERAL

.1 Factory assembled or field erected total energy recovery wheel arranged as indicated.

.2 Unit construction to Section 23 72 10 - Air handling units - built-up or 23 71 11 - Air Handling Units - Packaged.

.3 Performance:
- .1 Capacity: As indicated.
- .2 Efficiency: As indicated.

2.2 ENTHALPY MEDIA TYPE AIR TO AIR ROTARY HEAT EXCHANGER

.1 The rotor media shall be made of aluminum, coated to prohibit corrosion.

.2 All media surfaces shall be coated with a non-migrating solid absorbent layer prior to being formed into the honeycomb media structure to ensure that all surfaces are coated and the adequate latent capacity is provided.
.3 The media shall have a flame spread of less than 25 and a smoke development of less than 50 when rated in accordance with ASTM E84.
.4 In addition to the desiccant coating that is applied to the surfaces of the aluminum substrate, the two faces of the total energy recovery wheel shall be covered and sealed with a two part polymer heavy duty coating specifically chosen for chemical resistance.
.5 Desiccant shall be inorganic and specifically developed for the selective absorption of water vapour. Desiccant shall utilize a molecular sieve certified by the manufacturer to have an internal pore diameter distribution which limits absorption to materials no larger than 2.8 angstroms.
.6 Media shall be cleanable with low-pressure steam (less than 35 kPa), hot water or light detergent, without degrading the latent recovery. Dry particles up to 800 microns shall pass freely through media.

2.3 ROTOR

.1 Seals:
  .1 Supply rotor with labyrinth seals only, which at no time shall make contact with any rotating surface of the exchanger rotor face. These multi-pass seals shall utilize four labyrinth stages for optimum performance.
.2 Rotor Support System:
  .1 Provide rotor media in segmented fashion to allow for field erection or replacement of one section at a time without requiring side access. Rigidly hold media in place by a structural spoke system made of extruded aluminum.
.3 Rotor Housing:
  .1 The rotor housing to be a structural framework, which limits the deflection of the rotor due to air pressure loss to less than 0.8 mm Construct housing of galvanized steel to prevent corrosion. Support rotor is supported by two pillow block bearings which can be maintained or replaced without the removal of the rotor from its casing or the media from it spoke system.

2.4 TEMPERATURE CONTROL PANEL

.1 Provide variable speed control of unit using an A/C inverter.
.2 Inverter to include all digital programming with a manual speed adjustment on the front of the inverter.
.3 Drive system to allow for a turndown ration of 80:1 (20 rpm to 1/4 rpm).
.4 The control system shall include four sensors as follows:
  .1 Supply air temperature sensor.
  .2 Differential summer/winter changeover sensors mounted in the outdoor and return air streams.
  .3 Frost prevention sensor located in the exhaust air stream.
.5 Provide certified BACNet interface to allow monitoring and control of all wheel control parameters by the building control system specified in Division 25.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.
.2 Support independently of adjacent ductwork with flexible connections.

.3 Install access doors in accordance with Section 23 33 00 - Air Duct Accessories for access to coils, dampers, and motors.

3.3 CLEANING

.1 Proceed in accordance with Division 01 - General Requirements.
.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 FIELD QUALITY CONTROL

.1 Commissioning:
  .1 Manufacturer to:
    .1 Certify installation.
    .2 Start up and commission installation.
    .3 Carry out on-site performance verification tests.
    .4 Demonstrate operation and maintenance.
  .2 Provide Consultant at least 24 hours notice prior to inspections, tests and demonstrations. Submit written report of inspections and test results.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Rooftop air handling units including integral components specified.

1.2 RELATED SECTIONS

.1 Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
.2 Section 23 33 00 - Air Duct Accessories.
.3 Section 23 33 15 - Dampers - Operating.
.4 Section 23 41 00 - Particulate Air Filtration.
.5 Section 23 84 13 - Humidifiers.

1.3 REFERENCES

.1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)
  .1 ANSI/ARI 430-99, Central Station Air Handling Units.
.2 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
.3 Canadian Standards Association (CSA)
  .1 CSA B51 Boiler Pressure Vessel and Pressure Piping Code.
  .2 CSA B52 Mechanical Refrigeration Code.
.4 Sheet Metal and Air-Conditioning Contractor's National Association (SMACNA).
.5 American Bearing Manufacturer's Association (ABMA).
  .1 ANSI/ABMA 9 Load Ratings and Fatigue Life for Ball Bearings.
  .2 ANSI/ABMA 11 Load Ratings and Fatigue Life for Roller Bearings.
.6 Air Movement and Control Association (AMCA).
  .1 AMCA 210, Laboratory Method of Testing Fans for Aerodynamic Performance Rating (ASHRAE).
  .2 AMCA 300 Reverberant Room Method for Sound Testing of Fans.
.7 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE).
  .1 ASHRAE 68, Laboratory Method and Testing to Determine the Sound Power in a Duct.
  .2 ANSI/ASHRAE 90.1, (I-P) Energy Standard for Buildings Except Low-Rise Residential Buildings.
  .3 ANSI/ASHRAE 52.2 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
.8 National Electrical Manufacturer's Association (NEMA)
  .1 NEMA MGI Motors and Generators
  .2 NEMA ICS 7-1 Safety Standards of Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive System.
.9 Provincial Boiler, Pressure Vessel and Compressed Gas Regulations.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
.2 Indicate following: fan curves showing point of operation, motor drives, bearings, filters, mixing box, dampers, VAV, coils, include performance data.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Division 01 - General Requirements.

.2 Include following: fan, bearings, motor, damper, VAV control, air volume, total cooling, sensible cooling, EDB, EWB, OAT.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - General Requirements, and with the Waste Reduction Workplan.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Consultant.
.5 Divert unused paint material from landfill to official hazardous material collections site approved by Consultant.
.6 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Division 01 - General Requirements.
.2 Provide one spare sets of filters.
.3 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.
.4 Spare filters: in addition to filters installed immediately prior to acceptance by Consultant, supply 1 complete set of filters for each filter unit or filter bank.

2 Products

2.1 GENERAL

.1 Factory assembled components to form units supplying air at designed conditions, as indicated.
.2 Certify ratings: to ARI 430 with ARI seal.
.3 Horizontal and vertical type, as indicated, having air tight modular components, consisting of casing, fan section with motor and drive, filter section, dampers, section heating coil, humidifier spray section mixing box, blender air mixing device or filler mixing box, cooling coil, compressor, condenser coil, condenser fan, power exhaust.
.4 Acceptable material: York, McQuay, Carrier, Engineered Air.

2.2 CASINGS

.1 Galvanized steel 1.6 mm thickness reinforced and braced for rigidity.
    .1 Removable panels: provide access for maintenance of internal parts.
    .2 With wired glass 200 x 200 viewing port or zoo diameter polycarobonate double port hole. Paint steel parts, where not galvanized, with corrosion resistant paint to CGSB 1-GP-181M.
    .3 Finish entire units, inside and out, with rust resistant enamel.
.2 Line entire casing with minimum 1 mm thick, solid galvanized, steel liner

2.3 ACOUSTIC LINER

.1 Insulate internal surface of panels with 50 mm aluminum foil faced or neoprene coated rigid duct liner of 72 kg/m 3 density.
    .1 Apply with 100% coverage of adhesive with clip pins.
    .2 Cover with 0.8 mm thick perforated galvanized sheet metal.
    .3 Cover leading and trailing edges with sheet metal nosing and at edges around access doors and panels complete with 15 mm overlap.

2.4 ROOF CURB

.1 Provide full perimeter insulated roof mounting curve for sloped or flat roof as indicated, curb to be of heavy gauge sheet metal, complete with wood nailer, neoprene sealing strip and fall welded Z bar with 25 mm upturn on inner perimeter to provide a complete seal against the elements. 300 mm high minimum, curb to be supplied and installed by Division 23 roof flashing by General Contractors.

2.5 DRAIN PANS

.1 Construction: stainless steel, plastic or FRP Rounded corners, double well.
.2 Insulation: external foam type, minimum 13 mm thick.
.3 Drain connection: in bottom at low point.
.4 Installation: slope without sag minimum 1% to ensure no standing water at any time or at any point.
.5 Dimensions: minimum 75 mm from upstream face of coil to 150 mm beyond downstream face of coil or eliminator and to include return bends and headers.

2.6 FANS

.1 Cabinet hung or frame mounted, AMCA rated for sound and performance centrifugal fans with backward incline or airfoil wheels, selected to operate in stable part of performance curve at times and heavy duty L10 100,000 hour minimum service self aligning or split pillow block bearings.
    .1 Provide internally spring mounted motor as indicated complete with adjustable V-belt drive and guard.
    .2 Motor: As indicated.
.2 Maximum sound power levels, as indicated.

2.7 VIBRATION ISOLATION

.1 Flexible connections at inlet and outlet of fan section: to Section 23 33 00 - Air Duct Accessories.
.2 Vibration isolators on fan section: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment and Seismic Control.

2.8 VARIABLE VOLUME DEVICES

.1 Adjustable inlet vanes operated from centre mechanism linked to each damper vane or cantilevered vane mechanism.
    .1 Support vanes in self lubricated bronze bearings.
    .2 On DWDI fans interconnect vanes to operate simultaneously.
    .3 Provide locking devices for manual operation.
.2 Variable fan width sleeve mechanism with control linkage.
    .1 For DWDI fans, provide interconnected linkage to operate simultaneously.
    .2 Provide locking devices for manual operation.
.3 Variable speed drives: ___.
.4 Variable fan width disc, with control operator to move disc from rear of SWSI fan to front for 100% cut off.

2.9 FILTER BOX

.1 Material to match casing. For flat type filter arrangement: as indicated.
    .1 Provide access to filter through hinged door with suitable hardware.
.2 Provide blank-off plates and gaskets to prevent air bypass.
.3 Filters: to Section 23 41 00 - Particulate Air Filtration.

2.10 MIXING BOX

.1 Material to match casing and produce uniformly mixed air temperature within plus or minus 5°C of design across face of outlet.
.2 Dampers:
  .1 Dampers for mixing boxes: to Section 23 33 15 - Dampers - Operating.

2.11 BLENDER STATIC AIR MIXING DEVICE

.1 General:
  .1 Pre-engineered device with no moving parts, designed to thoroughly mix warm and cold air streams, to within 3°C at 40 Pa pressure drop and to provide for even velocity distribution profile.
.2 Sizing criteria:
  .1 Type: Static.
  .2 Size: to suit unit mixing box at mixer area to plenum area of 0.4, and minimum flow rate to maximum flow rate of 0.4 plenum, velocity 2.5 m/s.
  .3 Pressure drop: 40 Pa.
  .4 Capacity:
    .1 Outside air: As indicated L/s.
    .2 Return air: As indicated L/s.
  .5 Mixed air temperature: 12 deg C at outdoor air to supply air rate of 0.25 or 1.6 mm thick stainless steel.
.3 Construction:
  .1 2 mm thick aluminum.
.4 Blender section:
  .1 Blender in housing ready for insertion into air handling unit.
  .2 1.2 mm thick steel having 50 mm flanges on inlet and outlet, finished with corrosion resistant paint.
  .3 Complete with 25 mm, 32 kg/m3 density, fibreglass lining and insulated access door.
.5 Blender mixing box:
  .1 General: single unit consisting of dampers, blender, mixing section, with provision for floor mounting.
  .2 Construction: steel, with duct connection flanges, reinforced for rigidity, finished with corrosion resistant paint.
  .3 Dampers: parallel blade, low leakage, proportioning type.
    .1 Leakage: not more than 50 L/s.m2 at 750 Pa.
    .2 Seals: Neoprene on damper edges, top, bottom, sides of framing.
  .4 Blades of 1.6 mm thick steel, 150 mm maximum wide, locked to steel rods in rustproof bushings.
.6 Acceptable material: ___.

2.12 COILS

.1 Capacity: as indicated.
.2 Ratings: ARI certified.
.3 Construction:
  .1 Casings: 1.5 mm thick galvanized sheet steel.
    .1 Supports of galvanized steel channel.
    .2 Blank-off plates. Insulated sandwich construction.
  .2 Non-freeze steam coils: tube-in-tube type with internal perforated steam distributing tubes. Slope tubes to drain condensate.
    .1 Tubes: copper, brass or steel.
    .2 Fins: Aluminum.
    .3 Headers: cast iron, steel or cast brass.
    .4 Pressure tests: 1.7 MP.
  .3 Steam coils: single tube type.

.1 Tubes: copper, brass or steel.
.2 Fins: Aluminum.
.3 Headers: cast iron, steel and cast brass.
.4 Pressure tests: 1.7 MPa.

.4 Hot and chilled water coils: cleanable fins.
.1 Tubes: copper, Brass or Steel.
.2 Fins: Steel or Cast Brass.
.3 Headers: cast iron.
.4 Pressure tests: 1.7 MPa.

.5 Direct expansion refrigerant coils:
.1 Serpentine type, arranged to prevent trapping of oil.
.1 Liquid distributors to ensure even distribution of liquid refrigerant to all circuits.
.2 Silver solder or braze joints in refrigerant tubing.
.3 Evacuate and charge coil with nitrogen and seal before sending to site.
.2 Tubes: copper.
.3 Fins: Aluminum plate or spiral wound.
.4 Headers: copper.
.5 Pressure tests: to CSA B52 Canadian Refrigeration Code and carry a Canadian registration number. Dehydrated. Sealed with nitrogen charge.

2.13 HUMIDIFIERS

.1 To Section 23 84 13 - Humidifiers.

2.14 HEAT RECLAIM DEVICES

.1 As indicated and as per Section 23 72 00 - Air to Air Energy Recovery Equipment.

3 Execution

3.1 INSTALLATION

.1 Provide appropriate protection apparatus.
.2 Install units in accordance with manufacturer's instructions and as indicated.
.3 Ensure adequate clearance for servicing and maintenance.

3.2 FANS

.1 Install fan sheaves required for final air balance.
.2 Install flexible connections at fan inlet and fan outlets.
.3 Install vibration isolators.

3.3 DRIP PANS

.1 Install deep seal P-traps and trap seal primer on drip lines.
.1 Depth of water seal to be 1.5 times static pressure at this point.

3.4 COMMISSIONING

.1 Commissioning in Accordance with Section 01 91 13 - General Commissioning. Manufacturers Representative to provide one day on site per unit for start up and one day for commissioning in two separate visits. Provide start up reports.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section includes factory-assembled horizontal ducted water-to-air ground-source heat pumps and accessories required for a complete closed-loop ground-source heat-pump system.

1.2 RELATED SECTIONS

.1 Section 23 05 13, Common Motor Requirements for HVAC Equipment.
.2 Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment.
.3 Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.
.4 Section 23 05 93, Testing, Adjusting and Balancing for HVAC.
.5 Section 23 08 01, Performance Verification of Mechanical Piping Systems.
.6 Section 23 08 02, Cleaning and Start-Up of Mechanical Piping Systems.
.7 Section 23 20 21, Thermal Insulation for Piping.
.8 Section 23 21 15, Hydronic Pipinp - Copper.
.9 Section 23 21 16, Hydronic Piping - Steel.
.10 Section 25 30 01, EMCS Building Controllers.
.11 Section 25 90 01, EMCS Sequences of Operation.
.12 Division 26, electrical power and wiring.

1.3 REFERENCES

.1 Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
  .1 ANSI/AHRI/ASHRAE/ISO 13256-1, Water-Source Heat Pumps, Testing and Rating for Performance, Part 1: Water-to-Air and Brine-to-Air Heat Pumps.
.2 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)
  .1 ANSI/ARI 320, Standard for Water-Source Heat Pumps.
.3 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
  .1 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
.4 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  .1 ASHRAE Standard 15, Safety Standard for Refrigeration Systems.
  .2 ANSI/ASHRAE Standard 34, Designation and Safety Classification of Refrigerants.
.5 Canadian Standards Association (CSA Group)
  .1 CSA C448, Design and Installation of Ground Source Heat Pump Systems.
  .2 CSA B52:23, Mechanical refrigeration code.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Sections 01 33 00 - Submittal Procedures.
.2 Indicate:
  .1 Certified heating and cooling capacities at the scheduled entering air, airflow, entering fluid temperature, fluid flow, and glycol concentration.
  .2 Total and sensible cooling capacity.
  .3 Heating capacity.
  .4 Compressor, fan, and total unit electrical input.
  .5 EER and COP at applicable AHRI rating conditions and scheduled project conditions.
  .6 Air-side pressure drop and available external static pressure.
  .7 Water-side pressure drop.
  .8 Minimum and maximum entering-fluid temperatures.
  .9 Minimum and maximum fluid-flow rates.
  .10 Correction factors for the specified propylene-glycol concentration.
  .11 Fan-performance data at scheduled airflow and external static pressure.
  .12 Unit sound-power data by octave band for discharge, return, and cabinet-radiated sound.
  .13 Electrical MCA, MOCP, voltage, phase, compressor current, and fan-motor current.

.14 Dimensions, operating weight, service clearances, connection locations, and hanging-point locations.
.15 Factory-installed options and field-installed accessories.
.16 Control points, BACnet objects, alarm points, wiring diagrams, and sequence of operation.
.17 Refrigerant type, charge, safety classification, and required refrigerant-mitigation provisions.
.18 Minimum and maximum fluid flowrates.

.3 Equipment selections shall be based on scheduled conditions and the specified ground-loop fluid. Water-only ratings will not be accepted where the system contains glycol.

1.5 WARRANTY

.1 Provide standard manufacturer 12 month warranty.

2 Products

2.1 GENERAL

.1 Provide factory-assembled horizontal water-to-air ground-source heat pumps of the capacities, electrical characteristics, configurations, and arrangements indicated. Units shall be completely assembled, internally piped and wired, refrigerant charged, factory tested, and ready for connection to field ductwork, ground-loop piping, condensate drainage, electrical power, and building automation controls.

.2 Heat pumps: EPS 1/RA/2, CSA approved and carry ARI or CSA certification seal.

2.2 HORIZONTAL GROUND-SOURCE HEAT PUMP

.1 General:
.1 Factory-assembled horizontal water-to-air ground-source heat pump, complete with compressor, refrigerant circuit, reversing valve, air-to-refrigerant coil, water-to-refrigerant heat exchanger, supply fan, fan motor, filters, condensate drain pan, unit controller, safeties, and accessories required for complete operation.
.2 Unit configuration, capacity, airflow direction, return-air arrangement, discharge-air arrangement, and connection handing shall be as indicated.
.3 Units shall be suitable for operation with the specified inhibited propylene-glycol ground-loop solution over the full scheduled entering-fluid-temperature range.
.4 Units shall be factory assembled, internally piped and wired, refrigerant charged, leak tested, operationally tested, and ready for field connection.

.2 Performance: As indicated on drawings and/or schedule.
.1 Heating and cooling capacities shall be as indicated in the equipment schedule.
.2 Certify performance in accordance with ANSI/AHRI/ASHRAE/ISO 13256-1.
.3 Select units at the scheduled entering-air conditions, airflow, external static pressure, entering-fluid temperatures, fluid flow, and glycol concentration.
.4 Scheduled heating capacity shall be provided at the minimum scheduled entering-fluid temperature.
.5 Scheduled total and sensible cooling capacities shall be provided at the maximum scheduled entering-fluid temperature.
.6 Published water-only capacity or pressure-drop data shall be corrected for the specified glycol concentration and design fluid temperature.
.7 Unit shall not require supplemental electric heat to meet the scheduled heating capacity unless supplemental heat is specifically indicated.

.3 Cabinet:
.1 Heavy-gauge galvanized-steel construction with removable access panels.
.2 Cabinet panels shall permit access to compressor, fan, coil, drain pan, controller, filter, refrigerant components, and water connections without removal of adjacent ductwork or piping.

.3 Provide factory-installed hanger brackets and vibration-isolation provisions suitable for horizontal suspension.

.4 Compressor and refrigerant circuit:
- .1 Hermetic rotary or scroll compressor designed for heat-pump duty.
- .2 Compressor to be factory mounted on internal vibration isolators.
- .3 Provide four-way reversing valve, refrigerant metering device, filter-drier, service ports, and refrigerant pressure and temperature safeties.
- .4 Refrigerant: R-32 or R454b, factory charged.
- .5 Provide crankcase heater where recommended by the manufacturer for the selected unit and application.
- .6 Provide compressor anti-short-cycle protection and random restart following power restoration.

.5 Air-to-refrigerant coil:
- .1 Seamless copper tubes with mechanically bonded aluminum fins, or manufacturer’s standard construction for the certified unit.
- .2 Factory leak and pressure tested.
- .3 Provide protection against fin damage during shipment and construction. Remove protection before start-up.

.6 Water-to-refrigerant heat exchanger:
- .1 Coaxial or brazed-plate heat exchanger suitable for closed-loop ground-source service and the specified propylene-glycol solution.
- .2 Heat exchanger working pressure shall be not less than the system design pressure and field test pressure.
- .3 Provide refrigerant-to-water heat exchanger freeze protection based on refrigerant temperature or pressure.
- .4 Provide means to isolate or disable the compressor upon low fluid temperature, low refrigerant temperature, insufficient water flow, or conditions that could freeze the heat exchanger.

.7 Supply fan and motor:
- .1 Direct-drive centrifugal fan, statically and dynamically balanced.
- .2 Motor: Electronically commutated motor or VFD controlled with field-adjustable airflow.
- .3 Provide airflow adjustment through the unit controller or manufacturer’s commissioning interface.
- .4 Motor shall maintain the scheduled airflow against the scheduled external static pressure without exceeding motor rating.
- .5 Provide fan-motor overload and overtemperature protection.
- .6 Factory set fan airflow for the scheduled operating condition and verify during TAB.

.8 Filters:
- .1 Provide factory filter rack arranged for tool-free filter removal.
- .2 Filters: Minimum MERV 8, 50 mm nominal thickness, unless otherwise indicated.
- .3 Provide one complete spare filter set for each unit in addition to the clean final operating filter.
- .4 Filter dimensions shall be standard commercially available sizes where possible.

.9 Condensate system:
- .1 Provide drain connection, p-trap, and routing per manufacturer's recommendations.
- .2 Pipe indirect to nearest drain.
- .3 Provide factory-installed condensate overflow switch connected to the unit controller.

.10 Unit controls:
- .1 Provide factory-installed, factory-wired microprocessor unit controller.
- .2 Controller shall perform compressor staging, reversing-valve control, supply-fan control, compressor anti-short-cycle protection, condensate-overflow protection, freeze protection, high-pressure protection, low-pressure protection, refrigerant safety functions, and fault diagnostics.
- .3 Controller shall retain configuration and alarm history through loss of power.

.4 Unit shall automatically restart following restoration of power after an adjustable random delay, except where a manual-reset safety remains active.
.5 Provide diagnostic indication identifying the initiating fault.

.11 Building automation interface:
.1 Provide factory-installed BACnet communication interface unless otherwise indicated.
.2 Interface shall be BTL listed and shall communicate directly with Division 25 without a field-installed proprietary gateway.
.3 Ensure the following points available to the EMCS as applicable:
.1 Unit enable command.
.2 Occupancy command.
.3 Heating and cooling setpoints.
.4 Space or return-air temperature.
.5 Entering-fluid temperature.
.6 Leaving-fluid temperature.
.7 Supply-fan command and status.
.8 Compressor command and status.
.9 Heating mode.
.10 Cooling mode.
.11 Fan speed or airflow setting.
.12 Condensate overflow alarm.
.13 High-pressure alarm.
.14 Low-pressure alarm.
.15 Freeze-protection alarm.
.16 Refrigerant detection or mitigation alarm, where applicable.
.17 Common alarm and diagnostic code.
.18 Filter alarm.
.4 Coordinate the final BACnet points list, device addressing, baud rate, network wiring, and sequence of operation with Division 25.

.12 Electrical:
.1 Voltage, phase, frequency, MCA, and MOCP shall be as indicated.
.2 Provide factory-mounted disconnect switch where scheduled or indicated.
.3 Provide terminal blocks for power and control wiring.
.4 Equipment shall bear certification markings acceptable to the authority having jurisdiction.

.13 Accessories:
.1 Factory hanger kit.
.2 Vibration isolators.
.3 BACnet communication interface.
.4 Factory-installed condensate overflow switch.
.5 Motorized water-isolation valve and control relay, where indicated.
.6 750 mm hose kit, isolation valves, balancing valve, pressure-temperature test ports, strainer, and drain valve as indicated on the drawings and specified in the hydronic piping sections.
.7 Discharge-air and return-air connection arrangements as indicated.

.14 Noise and vibration requirements:
.1 Sound ratings: measured while in cooling mode.
.2 Maximum permissible outlet sound power levels (dB re 10-12 watts): as indicated:

Unit #:	**Octave Band Centre Frequencies:**						
	2	3	4	5	6	7	8
#1	63	59	54	50	41	38	37
#2	65	60	56	51	44	40	39
#3	--	--	--	--	--	--	--

.1 Where manufacturer cannot meet specific PWL, provide downstream or upstream silencer. Where radiated noise level exceeds specified PWL, provide special enclosure around entire unit, designed to fit in allotted space and yet still allow full access to unit for operation and maintenance.

.15 Acceptable material: Daikin, Water Furnace, Trane, York/JCI, Carrier, Bosch.

3 Execution

3.1 INSTALLATION

.1 Install where indicated and in accordance with manufacturer's instructions.

.2 Suspend horizontal units from structure using factory hanger brackets, threaded rods, vibration isolators, and supports designed for the operating weight of the unit. Do not support units from ductwork or piping.

.3 Connect supply and return ductwork using flexible connectors. Keep connectors properly aligned, free of wrinkles and sagging, and sufficiently loose to prevent vibration transmission without obstructing airflow.

.4 Install and level each unit before connecting ductwork, hydronic piping, and condensate drainage. Arrange connections so no strain is imposed on the unit casing, coil, drain pan, or piping connections.

.5 Install ground-loop piping connections in accordance with the manufacturer’s instructions and the applicable hydronic piping sections. Provide isolation valves, balancing device, strainer, pressure-temperature test ports, drain valve, and union or flexible hose connections as indicated.

.6 Flush and clean the ground-loop piping before connecting it to the unit. Do not circulate construction debris or cleaning chemicals through the heat-pump heat exchanger unless specifically accepted by the manufacturer.

.7 Support piping independently of the unit. Do not transmit piping weight or alignment forces to the heat-pump connections.

.8 Maintain manufacturer’s required service clearances. Arrange ductwork, piping, electrical conduit, hangers, and adjacent construction to permit removal of filters, fan assembly, compressor, controller, refrigerant components, and drain pan without removing unrelated permanent construction.

.9 Verify unit handing, return-air arrangement, discharge-air arrangement, filter-access side, piping side, electrical-access side, and service clearances before ordering equipment.

.10 Insulate ground-loop piping, valves, hose assemblies, and unit water connections where surface temperature may fall below the surrounding-air dew point. Maintain a continuous vapour barrier.

3.2 CONDENSATE DRAINAGE

.1 Install each heat pump level and in the orientation required by the manufacturer to provide complete condensate drainage.

.2 Connect field-installed condensate piping to the factory drain-pan connection.

.3 Provide condensate trap sized for the positive or negative static pressure at the drain-pan connection and in accordance with the heat-pump manufacturer’s written requirements.

.4 Provide cleanout and vent connections where required by the manufacturer.

.5 Support condensate piping independently of the heat pump. Do not impose piping loads on the factory drain connection.

.6 Grade condensate piping continuously toward the point of discharge.

.7 Insulate condensate piping where surface condensation could occur. Maintain a continuous vapour barrier.

.8 Before concealment, fill the factory drain pan and verify complete drainage without leakage, overflow, air binding, or carryover.

.9 Verify operation of the factory condensate overflow switch during start-up and confirm the associated unit shutdown and alarm functions.

3.3 START-UP AND COMMISSIONING

.1 Provide start-up by a factory-authorized service representative.
.2 Do not start equipment until the ground-loop system has been cleaned, flushed, filled, vented, chemically treated, and balanced, and until strainers are clean.
.3 Before start-up, verify:
  .1 Unit model, size, handing, and configuration.
  .2 Shipping restraints have been removed.
  .3 Unit is level and securely supported.
  .4 Filters are clean and correctly installed.
  .5 Ductwork is complete and air paths are unobstructed.
  .6 Condensate drainage is complete and tested.
  .7 Ground-loop fluid type and glycol concentration.
  .8 Ground-loop piping is flushed, vented, and free of debris.
  .9 Strainers are clean.
  .10 Design fluid flow is available.
  .11 Power supply voltage and phase.
  .12 Correct fan and compressor operation.
  .13 Control wiring and BAS communication.
.4 Operate each unit in heating and cooling modes and record:
  .1 Entering and leaving air temperatures.
  .2 Entering and leaving fluid temperatures.
  .3 Fluid flow and water-side pressure drop.
  .4 Airflow and external static pressure.
  .5 Compressor current.
  .6 Fan-motor current or power.
  .7 Refrigerant operating pressures or manufacturer diagnostic values.
  .8 Unit controller alarms and active diagnostic codes.
  .9 Condensate drainage.
  .10 BAS command, status, setpoint, and alarm communication.
.5 Verify operation of:
  .1 High-pressure protection.
  .2 Low-pressure protection.
  .3 Freeze protection.
  .4 Condensate overflow protection.
  .5 Compressor anti-short-cycle timer.
  .6 Power-failure restart sequence.
  .7 Refrigerant detection and mitigation functions, where applicable.
  .8 All BAS points and alarms.
.6 Adjust fan airflow to the scheduled value after duct-system TAB. Record final airflow setting in the commissioning report.
.7 Submit a completed manufacturer’s start-up report for each unit to the Consultant.
.8 Demonstrate operation, routine maintenance, filter replacement, alarm reset, controller access, and troubleshooting procedures to the Owner’s operating personnel.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
  .1 Methods and procedures for start-up, verification and commissioning, of the building Energy Monitoring and Control System (EMCS) and includes:
    .1 Start-up testing and verification of systems.
    .2 Check out demonstration or proper operation of components.
    .3 On-site operational tests.

1.2 RELATED SECTIONS

.1 The Contractor is to ensure that all related work is coordinated amojnt all specifications sections, as well as between all Divisions and that the tender price includes all related work. The reference sections below are provided for guidance and not necessarily a complete list of related sections.
  .1 Division 01 - General Requirements.
  .2 Section 01 91 13 - General Commissioning Requirements.
  .3 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.
.2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.
.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
  .1 Outage of main power supply in excess of back-up power sources, provided that:
    .1 Automatic initiation of back-up was accomplished.
    .2 Automatic shut-down and re-start of components was as specified.
  .2 Failure of communications link, provided that:
    .1 Controller automatically and correctly operated in stand-alone mode.
    .2 Failure was not due to failure of any specified EMCS equipment.
  .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
    .1 System recorded said fault.
    .2 Equipment defaulted to fail-safe mode.
    .3 AEL of total of all input sensors and output devices is at least 99 % during test period.

1.4 DESIGN REQUIREMENTS

.1 Confirm with Consultant that Design Criteria and Design Intents are still applicable.
.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.5 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements.
.2 Test plan shall be submitted for review with Controls System submittals.
.3 Final Report: submit report to Consultant.
  .1 Include measurements, final settings and certified test results.
  .2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by Consultant before commissioning is started.
.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Consultant in accordance with Division 01 - General Requirements.
.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.6 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review of Consultant before interim acceptance in accordance with Division 01 - General Requirements.
.2 Provide commissioning prefunctional check sheets, start-up sheets and functional performance testing sheets.

1.7 COMMISSIONING

.1 Do commissioning in accordance with Division 01 - General Requirements.
.2 Carry out commissioning under direction of Consultant and in presence of Owner's Representative.
.3 Inform, and obtain approval from, Consultant in writing at least 14 days prior to commissioning or each test. Indicate:
  .1 Location and part of system to be tested or commissioned.
  .2 Testing/commissioning procedures, anticipated results.
  .3 Names of testing/commissioning personnel.
.4 Correct deficiencies, re-test in presence of Consultant until satisfactory performance is obtained.
.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
.6 Install software in accordance to EMCS on site and at remote Owner's designated sites for use during commissioning and fo rtheir use afterwards. System communication shall be over high speed internet and use web browser based softward.
.7 Perform tests as required.

1.8 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Owner's Representative.

1.9 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.
.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.
.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.
.4 Locations to be approved, readily accessible and readable.
.5 Application: to conform to normal industry standards.

3 Execution

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.
.2 Commission each system using procedures prescribed by the Owner's Representative.
.3 Commission integrated systems using procedures prescribed by Owner's Representative.
.4 Debug system software.
.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
.6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

.1 Pre-Installation Testing.
  .1 General: consists of field tests of equipment just prior to installation.
  .2 Testing may be on site or at Contractor's premises as approved by Consultant.
  .3 Configure major components to be tested in same architecture as designed system. Include all required and control components.
  .4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).
  .5 Additional instruments to include:
    .1 DP transmitters.
  .6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source and to BECC.
  .7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.
  .8 Consultant to mark instruments tracking within 0.5 % in both directions as "approved for installation".
  .9 Transmitters above 0.5 % error will be rejected.
  .10 DP switches to open and close within 2% of setpoint.
.2 Completion Testing.
  .1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
  .2 Include following activities:
    .1 Test and calibrate field hardware including stand-alone capability of each controller.
    .2 Test and calibrate each AI using calibrated digital instruments.
    .3 Test each DI to ensure proper settings and switching contacts.
    .4 Test each DO to ensure proper operation and lag time.
    .5 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
    .6 Test operating software.
    .7 Test application software and provide samples of logs and commands.
    .8 Verify each CDL including energy optimization programs.
    .9 Debug software.
    .10 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.
    .11 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Consultant. This document will be used in final startup testing.

.3 Final Start-up Testing: provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Consultant. This document will be used in final startup testing.
- .1 2 technical personnel capable of re-calibrating field hardware and modifying software.
- .2 Detailed daily schedule showing items to be tested and personnel available.
- .3 Consultant's acceptance signature to be on executive and applications programs.
- .4 Commissioning to commence during final startup testing.
- .5 O&M personnel to assist in commissioning procedures as part of training.
- .6 Commissioning to be supervised by qualified supervisory personnel and Consultant.
- .7 Commission systems considered as life safety systems before affected parts of the facility are occupied.
- .8 Operate systems as long as necessary to commission entire project.
- .9 Monitor progress and keep detailed records of activities and results.

.4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.
- .1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.
  - .1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.
- .2 Test to last at least 30 consecutive 24 hour days.
- .3 Tests to include:
  - .1 Demonstration of correct operation of monitored and controlled points.
  - .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
- .4 System will be accepted when:
  - .1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
  - .2 Requirements of Contract have been met.
- .5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
- .6 Correct defects when they occur and before resuming tests.

.5 Owner's Representative to verify reported results.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Consultant, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

.1 Demonstrate to Owner's Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Division 01 - General Requirements.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
  .1 Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

1.2 RELATED SECTIONS

.1 Section 25 05 01 - EMCS: General Requirements.

1.3 DEFINITIONS

.1 CDL - Control Description Logic .
.2 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements, supplemented and modified by requirements of this Section.
.2 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Consultant prior to anticipated date of beginning of training.
  .1 List name of trainer, and type of visual and audio aids to be used.
  .2 Show coordinated interface with other EMCS mechanical and electrical training programs.
.3 Submit reports within one week after completion of Phase 1 training program that training has been satisfactorily completed.

1.5 QUALITY ASSURANCE

.1 Provide bilingual, competent instructors thoroughly familiar with aspects of EMCS installed in facility.
.2 Consultant reserves right to approve instructors.

1.6 INSTRUCTIONS

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.
.2 Training to be project-specific.

1.7 TIME FOR INSTRUCTION

.1 Number of days of instruction to be as specified in this section (1 day = 8 hours including two 15 minute breaks and excluding lunch time).

1.8 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training.
.2 Supply manual for each trainee, describing in detail data included in each training program.
  .1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.9 TRAINING PROGRAM

.1 To be in 2 phases over 6 month period.
  .1 Phase 1: 2 day program to begin before 30 day test period at time mutually agreeable to Contractor, Consultant.
    .1 Train O&M personnel in functional operations and procedures to be employed for system operation.

.2 Supplement with on-the-job training during 30 day test period.
.3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.
.4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.
.5 Introduction to direct digital controls and BACnet protocol.
.6 Identification of controls components.
.7 Review of DDC network diagram for the building.
.8 Review of shop drawings for building.
.9 Detailed discussions of sequence of operations.
.10 Walk-through of mechanical systems.

.2 Phase 2: 5 day program to begin 8 weeks after acceptance for operators, equipment maintenance personnel and programmers.
.1 Provide multiple instructors on pre-arranged schedule. Include at least following:
.1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.
.2 Equipment maintenance training: provide personnel with 2 days training within 5 day period in maintenance of EMCS equipment, including general equipment layout, trouble shooting and preventive maintenance of EMCS components, maintenance and calibration of sensors and controls.
.3 Programmers: provide personnel with 2 days training within 5 day period in following subjects in approximate percentages of total course shown:
.1 Software and architecture: 10%
.2 Application programs: 15%
.3 Controller programming: 50%
.4 Trouble shooting and debugging:10%
.5 Colour graphic generation: 15%

1.10 ADDITIONAL TRAINING

.1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.11 MONITORING OF TRAINING

.1 Consultant to monitor training program and may modify schedule and content.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.

1.2 RELATED SECTIONS

.1 Section 09 91 00 - Painting.
.2 Section 25 05 02 - EMCS: Submittals and Review Process.
.3 Section 25 05 54 - EMCS: Identification.
.4 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
  .1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.
.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
  .1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
  .1 ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.
.4 Canadian Standards Association (CSA International).
  .1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.
.5 Consumer Electronics Association (CEA).
  .1 CEA-709.1, Control Network Protocol Specification.
.6 Electrical and Electronic Manufacturers Association (EEMAC).
  .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).
.8 Transport Canada (TC).
  .1 Transportation of Dangerous Goods Act (TDGA).

1.4 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in EMCS:
  .1 AEL - Average Effectiveness Level.
  .2 AI - Analog Input.
  .3 AIT - Agreement on International Trade.
  .4 AO - Analog Output.
  .5 BACnet - Building Automation and Control Network.
  .6 BC(s) - Building Controller(s).
  .7 BECC - Building Environmental Control Center.
  .8 CAD - Computer Aided Design.
  .9 CDL - Control Description Logic.
  .10 CDS - Control Design Schematic.
  .11 COSV - Change of State or Value.
  .12 CPU - Central Processing Unit.
  .13 DI - Digital Input.
  .14 DO - Digital Output.
  .15 DP - Differential Pressure.

.16 ECU - Equipment Control Unit.
.17 EMCS - Energy Monitoring and Control System.
.18 HVAC - Heating, Ventilation, Air Conditioning.
.19 IDE - Interface Device Equipment.
.20 I/O - Input/Output.
.21 ISA - Industry Standard Architecture.
.22 LAN - Local Area Network.
.23 LCU - Local Control Unit.
.24 MCU - Master Control Unit.
.25 CUSMA - Canada United States Mexico Agreement
.26 NC - Normally Closed.
.27 NO - Normally Open.
.28 OS - Operating System.
.29 O&M - Operation and Maintenance.
.30 OWS - Operator Work Station.
.31 PC - Personal Computer.
.32 PCI - Peripheral Control Interface.
.33 PCMCIA - Personal Computer Micro-Card Interface Adapter.
.34 PID - Proportional, Integral and Derivative.
.35 RAM - Random Access Memory.
.36 SP - Static Pressure.
.37 ROM - Read Only Memory.
.38 TCU - Terminal Control Unit.
.39 USB - Universal Serial Bus.
.40 UPS - Uninterruptible Power Supply.
.41 VAV - Variable Air Volume.
.42 WAN - Wide Area Network.

1.5 DEFINITIONS

.1 Point: may be logical or physical.
  .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
  .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.
.2 Point Name: composed of two parts, point identifier and point expansion.
  .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor. "System" is system that point is located on.
    .1 Area descriptor: building or part of building where point is located.
    .2 System descriptor: system that point is located on.
    .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms.
  .2 Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
.3 Point Object Type: points fall into the following object types:
  .1 AI (analog input).
  .2 AO (analog output).
  .3 DI (digital input).
  .4 DO (digital output).
  .5 Pulse inputs.
.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.

.1 Printouts: to ANSI/IEEE 260.1.
.2 Refer also to Section 25 05 54- EMCS: Identification.

1.6 SYSTEM DESCRIPTION

.1 Refer to control schematics, sequence of operations and related Divisions of Specifications for system architecture.
.2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, the following:
  .1 Building Controllers.
  .2 Control devices as listed in I/O point summary tables.
  .3 OWS(s).
  .4 Data communications equipment necessary to affect EMCS data transmission system.
  .5 Field control devices.
  .6 Software/Hardware complete with full documentation.
  .7 Complete operating and maintenance manuals.
  .8 Training of personnel.
  .9 Acceptance tests, technical support during commissioning, full documentation.
  .10 Wiring interface co-ordination of equipment supplied by others.
  .11 Miscellaneous work as specified in these sections and as indicated.
.3 Design Requirements:
  .1 Design and provide conduit and wiring linking elements of system.
  .2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Consultant prior to installation.
  .3 Location of controllers as reviewed by Consultant prior to installation.
  .4 Provide utility power to EMCS and emergency power to EMCS as indicated.
  .5 Metric references: in accordance with CAN/CSA Z234.1.
.4 Language Operating Requirements:
  .1 Provide English operator selectable access codes.
  .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.
  .3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.
  .4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
  .5 Include, in English:
    .1 Input and output commands and messages from operator-initiated functions as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definements).
    .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points.
    .3 Reporting functions such as trend logs, trend graphics, alarm report logs, energy report logs, maintenance generated logs.
  .6 The network design to be a fully distributed network, with each primary system having its own locally mounted dedicated controller. Any failure in the network shall not in any way affect the control of these primary systems. Connecting hardware points from one system to more than one controller is not acceptable. Any points associated with a system are to be connected to one dedicated controller. Each dedicated controller to have a locally mounted control and display device to allow the operator to view and adjust any point on the controller.

.7 All wiring associated with the EMCS communication network as well as all control wiring and conduit associated with the EMCS.

.8 BACnet compliance: full compliance to the BACnet standard (ANSA / ASHRAE) 135, BACnet - A Data communication protocol for Building Automation and Control Networks is mandatory. Down to the field device level, the EMCS system must meet BACnet standards for system architecture and administration, and use open protocols and user friendly programming and graphics. Install the EMCS installed to communicate at the supervisory layer to the WAN using the BACnet TCP/IP protocol implemented on Ethernet.

.9 The EMCS system for the building is to be accessible by designated personnel via remote connection for monitoring and programming purposes. The EMCS Contractor is to provide all the required hardware, software, gateways etc, needed to permit remote connection to the EMCS. This shall include all hardware, software, programming, start-up and commissioning required. The Contractor is to supply and install all the required hardware and software on the operator workstation(s) located in Owner's facilities management department. In addition, a remote connection license to be provided allowing access directly to the system.

.10 **New EMCS must connect and be fully integratable with existing Siemens Controls System.**

.11 Standard of acceptance:

.1 Siemens, or equivalent manufacturer capable of full integration with the existing system.

1.7 SUBMITTALS

.1 Make submittals in accordance with Division 01 - General Requirements.

.2 Submit for review:

.1 Equipment list within 10 days after award of contract.

.2 List existing field control devices to be re-used included in bid, along with unit price.

.3 Quality Control:

.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by Consultant, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

.5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.

.6 Permits and fees: in accordance with general conditions of contract.

.7 Existing devices intended for re-use: submit test report.

1.8 QUALITY ASSURANCE

.1 Have local office within 50 km of project staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,

.2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.

.3 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

.4 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.
.5 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Division 01 - General Requirements.
.6 Be able to provide factory trained personnel on site within two (2) working days notice or provide instructions on maintenance and emergency service on system.
.7 BACnet devices to bear BACnet testing laboratories BTL mark and listed on BACnet manufacturers association website.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Consultant with schedule within 2 weeks after award of Contract.
.2 Waste Management and Disposal:
  .1 Separate waste materials for reuse in accordance with Division 01 - General Requirements.
  .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  .3 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
  .4 Separate for reuse and place in designated containers Steel waste in accordance with Waste Management Plan.
  .5 Place materials defined as hazardous or toxic in designated containers.
  .6 Handle and dispose of hazardous materials in accordance with Provincial Regulations.
  .7 Label location of salvaged material's storage areas and provide barriers and security devices.
  .8 Ensure emptied containers are sealed and stored safely.
  .9 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.
  .10 Fold up metal banding, flatten and place in designated area for recycling.

1.10 EXISTING CONDITIONS - CONTROL COMPONENTS

.1 Utilize existing control wiring as indicated.
.2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards specifications.
  .1 Do not modify original design of existing devices without written permission from Consultant.
  .2 Provide for new, properly designed device where re-usability of components is uncertain.
.3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
  .1 Furnish test report within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Consultant.
  .2 Failure to produce test report will constitute acceptance of existing devices by contractor.
.4 Non-functioning items:
  .1 Provide with report specification sheets or written functional requirements to support findings.
  .2 Owner will repair or replace existing items judged defective yet deemed necessary for EMCS.
.5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.

.6 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Consultant.
  .1 Be responsible for items repaired or replaced by Owner.
  .2 Be responsible for repair costs due to negligence or abuse of equipment.
  .3 Responsibility for existing devices terminates upon final acceptance of EMCS.
.7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

2 Products

2.1 ACCEPTABLE SYSTEMS, MANUFACTURERS

.1 Proposed system to have communication capability utilizing BACnet Protocol.
.2 Panel to be NEMA rated to suit environmental requirements.
.3 Panels to have hinged doors equipped with standard keyed-alike cabinet locks, keyed to same key.
.4 Wiring within panels to be contained within properly sized rigid PVC slotted wall wire duct. All wiring within the wire duct to be concealed with a non-slip cover.
.5 Terminations for the connection of power wiring, communication wiring and field mounted devices to be a properly identified terminal blocks mounted within the control panel.
.6 All control panels to be provided with an internally mounted 120 volt duplex power receptacle.
.7 All control panels to be identified with permanently mounted lamecoid tags to identify the control panel and the systems served by the control panel. Submit schedule of labels with shop drawing submission.
.8 Provide low voltage transformers in panels or elsewhere as required.
.9 Provide adaptors between metric and imperial components.

2.2 EQUIPMENT

.1 Control Network Protocol: to ASHRAE STD 135.
.2 Complete list of equipment and materials to be used on project and forming part of bid documents by adding manufacturer's name, model number and details of materials, and submit for approval.

2.3 ADAPTORS

.1 Provide adaptors between metric and imperial components.

3 Execution

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations. Provide printed copy of recommendations with shop drawings or product data.

3.2 PAINTING

.1 Painting: in accordance with NEMA, supplemented as follows:
  .1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
  .2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.
  .3 Clean and prime exposed hangers, racks, fastenings, and other support components.
  .4 Paint unfinished equipment installed indoors to NEMA

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes.
  .1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

1.2 RELATED SECTIONS

.1 Division 01 - General Requirements.
.2 Section 25 05 01 - EMCS: General Requirements.
.3 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 DESIGN REQUIREMENTS

.1 Preliminary Design Review: to contain following contractor and systems information.
  .1 Location of local office.
  .2 Description and location of installing and servicing technical staff.
  .3 Location and qualifications of programming design and programming support staff.
  .4 List of spare parts.
  .5 Location of spare parts stock.
  .6 Names of sub-contractors and site-specific key personnel.
  .7 Sketch of site-specific system architecture.
  .8 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
  .9 Descriptive brochures.
  .10 Sample CDL and graphics (systems schematics).
  .11 Response time for each type of command and report.
  .12 Item-by-item statement of compliance.
  .13 Proof of demonstrated ability of system to communicate utilizing BACnet Protocol.

1.5 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements and coordinate with requirements in this Section.
.2 Submit preliminary design document within thirty (30) working days after Contract Award, for review by Consultant.
.3 Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.
.4 Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.
.5 Soft copy to be in AutoCAD - latest version and Microsoft Word latest version format or PDF, structured using menu format for easy loading and retrieval on OWS.
.6 Submittals shall consist of:
  .1 Data sheets of all products.
  .2 Wiring and piping interconnection diagrams including panel and device power, and sources.
  .3 List of materials of all proposed devices and equipment.
  .4 Software documentation.
  .5 Sequence of operation, in text form.

.6 Application programs.
.7 Controls schematics and system diagrams.
.8 Project installation schedule.
.9 Names of sub-trades working for the EMCS Contractor.
.10 Mounting support details for components installed in airflow, waterflow and steam systems.
.11 Points Schedule.

.7 Submit shop drawings in a package which contains the various schedules and drawings which completely describe the control system installed. At a minimum the shop drawings package to contain the following items:
.1 Network drawing showing the network connection of all network control units, programmable control units, terminal control units and operator workstations to indicate the location of each of these elements.
.2 Schematic control diagram for each system being controlled. Where there are typical systems, a drawing is to be provided each system. This drawing to be on an AB sized sheet (11" x 17") and shall include a title block which includes as a minimum the drawing title, drawing number, project title, Contractor's name, Contractor's address & phone numbers, and a section to provide a record for revision information.
.3 The schematic control diagram to include a bill of materials which provides a list of all part numbers and descriptions for the control components on the drawing list to include field equipment as well as panel mounted components.
.4 The schematic control diagram to include a complete wiring diagram for all electrical connections, including motor starters, heating coils, coiling coils etc.
.5 The schematic control diagram to include a layout of the controls panels for each system. This layout to show the mounting of all panel equipment, including transformers, power supplies, controllers, transducers, sensors, relays, contactors and any other panel mounted equipment.
.6 The Contractor to include with the shop drawing submittal drawings, showing all wiring details for the connections of sensors, transducers, relays and contactors. These details to show terminal numbers and be referenced to the appropriate schedules and drawings.
.7 The Contractor to supply the shop drawing package a complete point schedule to show every point connected to the system. This schedule to be in a tabular format and provide the point identification, point type, wire tag, termination details reference, referenced drawings, device mounting location and device code numbers.
.8 The point schedule to provide at a minimum the following information on the software attributes of the point:
.1 Tag name - ex. EPT-1
.2 Point type - ex. AO-3
.3 System name - ex. A/C-1
.4 Object name - H-VLV
.5 Expanded ID - Heating control valve.
.6 Units of measurement - %.
.9 The point schedule to provide at a minimum the following information on the digital controller to which the point is connected:
.1 Controller type - ex. Unitary controller.
.2 Controller address - ex. 256
.3 Cable destination - the termination at the controller, ex. AO-1
.4 Terminal numbers - the termination at the controller.
.10 The point schedule to provide at a minimum the following information on the control panel:
.1 Panel identification
.2 Panel location
.3 Reference drawing

.11 The point schedule to provide at a minimum the following information on any intermediate device which may be associated with the point:
  .1 Type of wiring or tubing used
  .2 Device part number
  .3 Location of the device
  .4 Reference details

.12 The point schedule to provide at a minimum the following information on any field device which may be associated with the point:
  .1 Type of wiring or tubing used
  .2 Device part number
  .3 Location of the devices
  .4 Reference details

.13 The Contractor to supply with the shop drawing package a complete room schedule, to show the equipment associated with the room controls. Schedule to be in tabular format and provide the room number and location, terminal unit number, part numbers for the terminal unit controller, sensors and actuators. Included on this schedule terminal unit type, size, minimum flow and maximum flow.

.14 Sequence of operation for each system controlled. Sequence to be in complete conformance with the sequence of operations included with this specification. Any changes require the approval of the Owner's Representative in writing. Sequence to include all modes of operation including fail safe, emergency and fire modes.

.15 Valve schedule including design flow, CV, size, type, actuator, pressure drop, torque requirements and maximum shut off pressure differential for each control valve.

.16 Damper schedule including design air flow, size, type, actuator pressure drop and maximum shut off pressure differential for each control damper.

.17 Provide one (1) permanent, not fading, as-built copy of each control drawing, enclosed by an aluminum frame with glass cover, or sealed by plastic laminate in rigid metal bound frame. To be installed at each respective control panel location.

.18 Catalogue cut sheets of all equipment used. This includes, but is not limited to DDC panels, peripherals, sensors, actuators, dampers, control air system components etc.

.19 Range and scale information for all transmitters and sensors. This sheet to clearly indicate one (1) device and any applicable options. Where more than one (1) device to be used is on a single sheet, submit two (2) sheets - individually marked.

.20 Hardware data sheets for all operator workstations, local access panels and portable operator terminals.

.21 Software manuals for all applications programs to be provided as a part of the operator workstations, portable operator terminals, programming devices and so forth for.

1.6 PRELIMINARY SHOP DRAWING REVIEW

.1 Submit preliminary shop drawings within 30 working days of award of contract and include following:
  .1 Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.
  .2 Detailed system architecture showing all points associated with each controller including signal levels and pressures where new EMCS ties into existing control equipment.
  .3 Spare point capacity of each controller by number and type.
  .4 Controller locations.
  .5 Auxiliary control cabinet locations.

.6 Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.
.7 Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).
.8 Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.
.9 Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.
.10 Compressor schematic and sizing data as applicable..

1.7 DETAIL SHOP DRAWING REVIEW

.1 Submit detailed shop drawings within sixty (60) working days after award of contract and before start of installation and include following:
.1 Corrected and updated versions (hard copy only) of submissions made during preliminary review.
.2 Wiring diagrams.
.3 Piping diagrams and hook-ups.
.4 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
.5 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
.1 Sensing element type and location.
.2 Transmitter type and range.
.3 Associated field wiring schematics, schedules and terminations.
.4 Pneumatic schematics and schedules.
.5 Complete Point Name Lists.
.6 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
.7 Software and programming details associated with each point.
.8 Manufacturer's recommended installation instructions and procedures.
.9 Input and output signal levels or pressures where new system ties into existing control equipment.
.6 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.
.7 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.
.8 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.
.9 Listing and example of specified reports.
.10 Listing of time of day schedules.
.11 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.
.12 Full description of software programs provided.
.13 Sample of "Operating Instructions Manual" to be used for training purposes.
.14 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.8 QUALITY ASSURANCE

.1 Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:
  .1 Undertake functional review of preliminary design documents, resolve inconsistencies.
  .2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).
  .3 Review interface requirements of materials supplied by others.
  .4 Review "Sequence of Operations".
.2 Contractor's programmer to attend meeting.
.3 Consultant retains right to revise sequence or subsequent CDL prior to software finalization without cost to Consultant.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes.
  .1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

1.2 RELATED SECTIONS

.1 Section 25 05 01 - EMCS: General Requirements.
.2 Section 25 05 02 - EMCS: Submittals and Review Process.
.3 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.3 DEFINITIONS

.1 BECC - Building Environmental Control Centre.
.2 OWS - Operator Work Station.
.3 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.4 SUBMITTALS

.1 Submittals in accordance with Division 01 - General Requirements, supplemented and modified by requirements of this Section.
.2 Submit Record Documents, As-built Drawings, Operations and Maintenance Manuals to Consultant in English.
.3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.
  .1 Binders to be 2/3 maximum full.
  .2 Provide index to full volume in each binder.
  .3 Identify contents of each manual on cover and spine.
  .4 Provide Table of Contents in each manual.
  .5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.
.4 Submitt all documents through and electronic documents management system.
  .1 Documents shall be in a PDF format.
  .2 All documents shall be indexed and searchable for ease of use.
.5 Training Material:
  .1 Include all training material used during system handover in both hard and soft copies.
  .2 Material should cover system operation, maintenance and energy procedures.

1.5 AS-BUILTS

.1 Provide one (1) copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:
  .1 Changes to contract documents as well as addenda and contract extras.
  .2 Changes to interface wiring.
  .3 Routing of conduit, wiring and control air lines associated with EMCS installation.
  .4 Locations of obscure devices to be indicated on drawings.
  .5 Listing of alarm messages.
  .6 Panel/circuit breaker number for sources of normal/emergency power.
  .7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
.9 Basic system design and full documentation on system configuration.

.2 Submit for final review by Consultant.
.3 Provide before acceptance four (4) hard and one (1) soft copy incorporating changes made during final review.
.4 In addition to hardware documentation, include detailed As-Built documentation for all software components.
.5 Document any customizations, configurations or integrations made during the project.

1.6 O&M MANUALS

.1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.
.2 Provide two (2) complete sets of hard and soft copies prior to system or equipment tests.
.3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.
.4 Functional description to include:
.1 Functional description of theory of operation.
.2 Design philosophy.
.3 Specific functions of design philosophy and system.
.4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.
.5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.
.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.
.5 System operation to include:
.1 Complete step-by-step procedures for operation of system including required actions at each OWS.
.2 Operation of computer peripherals, input and output formats.
.3 Emergency, alarm and failure recovery.
.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.
.6 Software to include:
.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.
.2 Detailed descriptions of program requirements and capabilities.
.3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.
.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device
.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.
.6 Software for each Controller and single section referencing Controller common parameters and functions.

.7 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.

.8 System configuration document:

.1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.

.2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

.10 Troubleshooting Guides:

.1 Incorporate detailed troubleshooting guides, into the Operations & Maintenance Manuals.

.2 These guides should provide step by step instructions for diagnosing and resolving common system issues.

.11 Feedback and Improvement Log:

.1 Include a section for documenting feedback and improvements suggested or implemented during the project and operational phase.

.2 This log should be a living document, regularly updated to reflect ongoing enhancements.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes.
  .1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates materials, colours and lettering sizes.
  .2

1.2 RELATED SECTIONS

.1 Section 25 05 01 - EMCS: General Requirements.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).
  .1 CSA C22.1, The Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

1.4 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

1.5 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.6 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures supplemented and modified by requirements of this Section.
.2 Submit to Consultant for approval samples of nameplates, identification tags and list of proposed wording.

2 Products

2.1 NAMEPLATES FOR PANELS

.1 Identify by Plastic laminate, 3 mm thick Melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core. Mechanically attached with self tapping screws.
.2 Sizes: 25 x 67 mm minimum.
.3 Lettering: minimum 7 mm high, black.
.4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Identify by plastic encased cards attached by plastic tie.
.2 Sizes: 50 x 100 mm minimum.
.3 Lettering: minimum 5 mm high produced from laser printer in black.
.4 Data to include: point name, point address, make and model number.
.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

.1 Identify by stick-on labels using point identifier.
.2 Location: as directed by Consultant.
.3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

.1 Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.
.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Consultant's.

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.
.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.
.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 CONDUIT

.1 Colour code EMCS conduit.
.2 Pre-paint box covers and conduit fittings.
.3 Coding: use fluorescent orange paint and confirm colour with Consultant during "Preliminary Design Review".

3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 EXISTING PANELS

.1 Correct existing nameplates and legends to reflect changes made during Work.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Division 01 - General Requirements.
.2 Section 07 84 00 - Firestopping.
.3 Section 21 05 01 - Common Work Results - Mechanical.
.4 Section 23 05 01 - Installation of Pipework.
.5 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
.6 Section 25 05 01 - EMCS - General Requirements.
.7 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
  .1 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressures Fittings.
  .2 ANSI C2, National Electrical Safety Code.
  .3 ANSI/NFPA 70, National Electrical Code.
.2 Canadian Standards Association (CSA)
  .1 CSA C22.1, Canadian Electrical Code, Part 1.
  .2 CAN/CSA C22.3No.1, Overhead Systems.

1.3 SYSTEM DESCRIPTION

.1 Division 25 Electrical:
  .1 Provide power wiring from dedicated junction boxes (by Div. 26) to EMCS field panels. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.
  .2 Provide hard wiring between field control devices and EMCS field panels.
  .3 Provide communication wiring between EMCS field panels and OWS. Where communication is to occur over ethernet / IP / corporate intranet, controls shall be responsible for CAT 5 / CAT 6 cabling between devices and data rooms.
  .4 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
  .5 Refer to wiring diagrams included as part of flow diagrams in section. Trace existing control wiring installation and provide updated wiring schematics including additions and/or deletions to control circuits for approval by engineer before commencing work.
.2 Division 25 Pneumatic:
  .1 Pneumatic tubing, valves and fittings for field control devices. Including demolition and modification of existing devices.
.3 Division 25 Mechanical:
  .1 Pipe Taps required for EMCS equipment will be supplied and installed by Mechanical Piping Contractor.
  .2 Wells and Control Valves shall be supplied by EMCS Contractor and Installed by Mechanical Plumbing/Piping Contractor.
  .3 Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by Sheet Metal Contractor. Costs to be carried by designated trade.
.4 Structural:
  .1 Special steel work as required for installation of work.

1.4 PERSONNEL QUALIFICATIONS

.1 Qualified factory trained supervisory personnel to:
  .1 Continuously direct and monitor all work.
  .2 Attend site meetings.

1.5 EXISTING CONDITIONS

.1 Cutting and Patching: refer to Division 01 - General Requirments, supplemented as specified herein.
.2 Repair all surfaces damaged during execution of work.
.3 Turn over to Engineer existing materials removed from work not identified for reuse.

2 Products

2.1 SPECIAL SUPPORTS

.1 Structural grade steel, primed and painted after construction and before installation.

2.2 WIRING

.1 As per requirements of Division 26.
.2 For 70V and above copper conductor with chemically cross linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.
.3 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.
.4 Sizes:
    .1 Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.
    .2 Field wiring to digital device: #18AWG 20AWG stranded twisted pair.
    .3 Analog input and output: shielded #18 minimum solid copper #20 minimum stranded twisted pair. Wiring must be continuous without joints.
    .4 More than 4 conductors: #22 minimum solid copper.

2.3 CONDUIT

.1 As per requirements of Division 26.

2.4 WIRING DEVICES, COVER PLATES

.1 As per requirements of Div 26.

2.5 STARTERS, CONTROL DEVICES

.1 Starter diagrams:
    .1 Provide copy of wiring and schematic diagrams mount one copy in each starter with additional copies for operation and maintenance manual.
.2 Auxiliary Control Devices:
    .1 Control transformers: 60 Hz, primary voltage to suit supply, 120 V single phase secondary, VA rating to suit load plus 20% margin.
    .2 Auxiliary contacts: one "Normally Open" and one "Normally Closed" spare auxiliary contact in addition to maintained auxiliary contacts as indicated.
    .3 Hand Off Automatic switch: heavy duty type, knob lever operator.
    .4 Double voltage relays: with barrier to separate relay contacts from operating magnet. Operating coil voltage and contact rating as indicated.
.3 Finish for starters:
    .1 Exterior: in accordance with Section 26 05 00 - Common Work Results - Electrical.
    .2 Interior: white.

2.6 SUPPORTS FOR CONDUITS, FASTENINGS, EQUIPMENT

.1 As per requirements of Div 26.

3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
.2 As per requirements of Div 26.

3.2 MECHANICAL PIPING

.1 As per requirements of Div 23 and performed by Div 23.

3.3 ELECTRICAL GENERAL

.1 Do complete installation in accordance with requirements of:
  .1 Division 26, this specification.
  .2 CSA 22.1-24 Canadian Electrical Code.
  .3 ANSI/NFPA 70.
  .4 ANSI C2.
.2 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage above 70 V contacts and mark to prevent accidental injury.
.3 Conform to manufacturer's recommendations for storage, handling and installation.
.4 Check factory connections and joints. Tighten where necessary to ensure continuity.
.5 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.
.6 Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.
.7 Install conduits, and sleeves prior to pouring of concrete.
.8 Holes through exterior wall and roofs: flash and make weatherproof.
.9 Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.
.10 Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

3.4 CONDUIT SYSTEM

.1 FT6 cable shall be allowed in lieu of conduit above ceilings. Cables installed in exposed ceiling and inside walls must be in conduit.
.2 Install terminal blocks or strips as specified by Division 26.

3.5 WIRING

.1 Provision of all wiring associated with and required by the BAS, shall be the responsibility of this Contractor. The term "wiring" shall include wiring, conduit, miscellaneous material and labour required to install a total working system.
.2 Install multiple wiring in ducts simultaneously.
.3 Do not pull spliced wiring inside conduits or ducts.
.4 Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.
.5 Tests: use only qualified personnel. Demonstrate that:
  .1 Circuits are continuous, free from shorts, unspecified grounds.
  .2 Resistance to ground of all circuits is greater than 50 Megohms.
.6 Provide Engineer Consultant with test results showing locations, circuits, results of tests.
.7 Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.
.8 Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.

.9 Do not allow wiring to come into direct physical contact with compression screw.
.10 Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

3.6 WIRING DEVICES, COVER PLATES

.1 Receptacles:
  .1 As per the requirements of Div 26.

3.7 STARTERS, CONTROL, DEVICES

.1 Install and make control connections as indicated.
.2 Identify each wire, terminal for external connections with permanent number marking identical to diagram.
.3 Performance Verification:
  .1 Operate switches and controls to verify functioning.
  .2 Perform start and stop sequences of contactors and relays.
  .3 Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

3.8 GROUNDING

.1 Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.
.2 As per requirements of Div 26.

3.9 TESTS

.1 General:
  .1 Perform following tests in addition to tests specified Section 25 08 20 EMCS: Warranty and Maintenance.
  .2 Give 14 days written notice of intention to test.
  .3 Conduct in presence of Engineer Consultant and authority having jurisdiction.
  .4 Conceal work only after tests satisfactorily completed.
  .5 Report results of tests to Engineer Consultant in writing.
  .6 Preliminary tests:
    .1 Conduct as directed to verify compliance with specified requirements.
    .2 Make needed changes, adjustments, replacements.
    .3 Insulation resistance tests:
      .1 Test insulation between conductors and ground, efficiency of grounding system to satisfaction of Consultant and authority having jurisdiction.

3.10 IDENTIFICATION

.1 Refer to Section 25 05 54 - EMCS Identification.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).

1.2 RELATED SECTIONS

.1 Section 25 05 01 - EMCS: General Requirements.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).
  .1 CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/TIA/EIA-568-A with modifications).
  .2 CSA T530, Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A with modifications).
.2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements.
  .1 IEEE Std 802.3TM, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.
.3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)
  .1 TIA/EIA-568, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements Part 2 Balanced Twisted-Pair Cabling Components Part 3 Optical Fiber Cabling Components Standard.
  .2 TIA/EIA-569-A, Commercial Building Standard for Telecommunications Pathways and Spaces.
.4 Treasury Board Information Technology Standard (TBITS).
  .1 TBITS 6.9, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings - Technical Specifications.

1.4 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS - General Requirements.

1.5 SYSTEM DESCRIPTION

.1 Data communication network to link Operator Workstations(OW), BCs, ECs, and TCUs, in accordance with CSA T529, TIA/EIA-568, CSA T530 and TSA/EIA 569-A.
  .1 Provide reliable and secure connectivity of adequate performance between different sections (segments) of network.
  .2 Allow for future expansion of network, with selection of networking technology and communication protocols.
.2 Data communication network to include, but not limited to:
  .1 EMCS-LAN.
  .2 Modems.
  .3 Network interface cards.
  .4 Network management hardware and software.
  .5 Network components necessary for complete network.

1.6 DESIGN REQUIREMENTS

.1 EMCS Local Area Network (EMCS-LAN).

.1 High speed, high performance, local area network over IP with BCs, ECs, TCUs, and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.
.2 EMCS-LAN to: BACnet protocol.
.3 Each EMCS-LAN to be capable of supporting at least 50 devices.
.4 Support of combination of BCs, ECs, TCUs, and OWSs directly connected to EMCS-LAN.
.5 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices.
.6 Detection and accommodation of single or multiple failures of either OWSs, BCs, ECs, TCUs,or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.
.7 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.

.2 Dynamic Data Access.
.1 LAN to provide capabilities for OWSs, either network resident or connected remotely, to access point status and application report data or execute control functions for other devices via LAN.
.2 Access to data to be based upon logical identification of building equipment.

.3 Network Medium.
.1 Network medium: twisted cable, shielded twisted cable or fibre optic cable compatible with network protocol to be used within buildings. Fibre optic cable to be used between buildings.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 GENERAL

.1 Provide for connection between BCs, ECs, TCUs, and OWS using structured cabling system.
.2 Install in accordance with requirements of Division 26 - Electrical.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation for building automation controllers including:
    .1 Building Controllers (BCs)
    .2 Equipment Controllers (ECs)
    .3 Terminal Unit Controllers (TCUs)
    .4 Local Control Unit (LCU).

1.2 RELATED SECTIONS

.1 Section 25 05 01 - EMCS: General Requirements.
.2 Section 25 05 02 - EMCS: Submittals and Review Process.
.3 Section 25 05 03 - EMCS: Project Record Documents.
.4 Section 25 30 02 - EMCS: Field Control Devices.
.5 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

1.3 REFERENCES

.1 ASHRAE
  .1 ASHRAE, Applications Handbook, SI Edition.
  .2 ASHRAE Standard 135 - BACnet - A Data Communications Protocol for Building Automation and Control Networks.
  .3 ANSI/ASHRAE Standard 135.1 - Method of Test for Conformance to BACnet.
.2 CSA
  .1 CSA C22.2 No. 205 - Signal Equipment.
.3 BACnet Testing Laboratories (BTL)
  .1 BTL Listed Devices.

1.4 DEFINITIONS

.1 Acronyms used in this Section include: See Section 25 05 01 - EMCS: General Requirements.

1.5 SYSTEM DESCRIPTION

.1 General
  .1 Provide a distributed Building Automation System (BAS) consisting of Building Controllers (BCs), Equipment Controllers (ECs), and Terminal Unit Controllers (TCUs) interconnected by the BAS network.
  .2 Provide sufficient controllers, input/output capacity, processing capability, communications infrastructure, and associated hardware required to perform the sequences of operation specified herein.
  .3 Controller quantities, point allocations, and network architecture shall be submitted for Consultant review as part of the BAS shop drawing submission.
  .4 The BAS shall be fully integrated such that data, alarms, schedules, trends, setpoints, and operating parameters may be shared throughout the BAS network as required by the sequences of operation.
.2 Building Controllers (BCs)
  .1 Building Controllers shall provide supervisory control, network coordination, scheduling, trending, alarm management, optimization routines, data sharing, and integration between equipment controllers and operator workstations.
  .2 BCs shall support peer-to-peer communication with other BCs, ECs, and TCUs without requiring the operator workstation to remain online.

.3 Building Controllers shall continue normal operation during loss of communication with other network devices to the extent possible using locally available information.

.3 Equipment Controllers (ECs)

.1 Equipment Controllers shall provide direct digital control of HVAC equipment and systems including, but not limited to, air handling units, rooftop units, pumps, heat recovery systems, hydronic systems, and associated equipment.

.2 Equipment Controllers shall execute all required control sequences, interlocks, safeties, alarms, scheduling functions, and optimization routines associated with the controlled equipment.

.3 Equipment Controllers shall continue to operate independently during loss of communication with other controllers or supervisory devices.

.4 Terminal Unit Controllers (TCUs)

.1 Terminal Unit Controllers shall provide direct digital control of terminal equipment including, but not limited to, VAV terminals, fan-powered terminals, unit ventilators, fan coil units, cabinet unit heaters, radiant systems, and similar devices.

.2 Terminal Unit Controllers shall perform all control functions independently of the BAS network and shall continue operation during network communication failures.

.5 Controller Requirements

.1 Controllers shall be fully programmable, microprocessor-based devices specifically designed for building automation applications.

.2 Controllers shall include all hardware, firmware, software, communications interfaces, memory, power supplies, and accessories required for a complete and operational system.

.3 Controllers shall execute control sequences using locally connected inputs and outputs and shall not rely on continuous communication with other controllers to maintain normal control operation.

.4 Secondary supervisory inputs, including but not limited to outdoor air temperature, building demand signals, optimization parameters, reset schedules, occupancy status, and similar system-wide values, may be shared across the BAS network.

.5 Controllers shall retain all application programs, schedules, alarms, trends, setpoints, calibration data, and configuration information during power interruptions without requiring reloading of software or databases.

.6 Controllers shall automatically resume normal operation following restoration of power.

.7 Controllers shall support online programming, commissioning adjustments, firmware updates, and application modifications without replacement of controller hardware.

.6 Communications

.1 Controllers shall communicate using the BAS network architecture and protocols specified in Division 25.

.2 Controllers shall support peer-to-peer data exchange across the BAS network.

.3 Controllers shall support time synchronization, alarm transmission, data sharing, trending, scheduling, and other network functions required for system operation.

.4 Remote access, where provided, shall utilize secure IP-based communications and shall comply with Owner IT and Division 25 cybersecurity requirements.

.7 System Resilience

.1 Failure of any single controller shall not impair operation of unrelated controllers or systems.

1.6 DESIGN REQUIREMENTS

.1 General

.1 Controllers shall perform all monitoring, control, alarming, scheduling, trending, optimization, and communications functions required by the specified sequences of operation.

.2 Controllers shall support analog inputs (AI), analog outputs (AO), digital inputs (DI), and digital outputs (DO) as required by the application.
.3 Provide sufficient controller capacity to support all specified points and future expansion requirements.
.4 Provide minimum spare capacity of 20% for each input and output point type and minimum 20% spare processing and memory capacity for future expansion.

.2 Input/Output Requirements
.1 Analog Inputs
.1 Support the following signal types as required:
.1 4-20 mA
.2 0-10 VDC
.3 Resistance temperature sensors and thermistors
.4 Other sensor types as required by the application.
.2 Analog Outputs
.1 Support the following signal types as required:
.1 4-20 mA
.2 0-10 VDC
.3 Digital Inputs
.1 Accept dry contacts and pulse inputs as required by the application.
.2 Provide status monitoring and alarm functionality as required by the sequence of operation.
.4 Digital Outputs
.1 Provide relay or electronic switching outputs suitable for the controlled load.
.2 Provide interposing relays where required by connected equipment.
.3 Controller Assemblies
.1 Provide power supplies, input/output modules, enclosures, communication interfaces, terminal blocks, and accessories required for a complete and operational installation.
.2 Provide removable screw-type or spring-clamp terminal blocks suitable for field wiring.
.3 Failure of any individual controller shall not impair operation of unrelated controllers or systems.
.4 Controllers shall place outputs into the required fail-safe condition as defined by the sequence of operation.
.5 Environmental Requirements
.1 Controllers and associated hardware shall be suitable for operation within ambient conditions of:
.1 Temperature: 0°C to 50°C minimum.
.2 Relative Humidity: 10% to 90%, non-condensing.
.6 Enclosures
.1 Controllers shall be installed within manufacturer-approved control panels or equipment enclosures.
.2 Wall-mounted control panels shall include hinged lockable doors.
.3 Enclosures shall protect internal components from dust, moisture, and incidental water exposure while providing adequate ventilation.
.7 Protection
.1 Provide surge protection for controller power supplies, communication networks, and field wiring as recommended by the manufacturer.
.2 Provide protection against low voltage, power interruption, and transient voltage conditions.

1.7 SUBMITTALS

.1 Make submittals in accordance with DIvision 01 - General Requirements and Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.1 Submit product data sheets for each product item proposed for this project.

1.8 MAINTENANCE PROCEDURES

.1 Provide manufacturers recommended maintenance procedures for insertion in Section 25 05 03 - EMCS: Project Record Documents.

2 Products

2.1 BUILDING CONTROLLERS (BC)

.1 General:
- .1 Building Controllers (BCs) shall provide supervisory control, coordination, scheduling, trending, alarming, optimization, and data sharing functions for the Building Automation System (BAS).
- .2 Building Controllers shall support communication between operator workstations, equipment controllers, terminal unit controllers, and integrated systems.
- .3 Building Controllers shall support peer-to-peer communication and data exchange throughout the BAS network.
- .4 Building Controllers shall perform all required supervisory functions without reliance on the operator workstation remaining online.
- .5 Building Controllers shall support all sequences of operation specified herein.

.2 Control Functions
- .1 Building Controllers shall provide the following functions as required by the application:
  - .1 Time-of-day scheduling.
  - .2 Calendar scheduling.
  - .3 Holiday scheduling.
  - .4 Temporary schedule overrides.
  - .5 Alarm management and routing.
  - .6 Trend collection and storage.
  - .7 System-wide optimization routines.
  - .8 Network-wide data sharing.
  - .9 Supervisory reset strategies.
  - .10 Energy management functions.
- .2 Building Controllers shall support supervisory control algorithms including, but not limited to:
  - .1 PID control.
  - .2 Equipment interlocking.
  - .3 Supply air temperature reset.
  - .4 Static pressure reset.
  - .5 Chilled water reset.
  - .6 Heating water reset.
  - .7 Demand limiting.
  - .8 Economizer and enthalpy control
- .3 Controller Hardware
  - .1 Controllers shall be fully programmable, microprocessor-based devices specifically designed for building automation applications.
  - .2 Controllers shall be provided with sufficient processing capacity, memory, and communication resources to perform all specified functions while maintaining reliable operation.
  - .3 .3 configuration data, and operating parameters shall be retained through power interruptions without requiring battery-backed memory.
  - .4 Controllers shall automatically resume normal operation following restoration of power.

.5 Controllers shall incorporate an integral real-time clock and support network time synchronization.
.6 Controllers shall support online programming, database modifications, and firmware upgrades without replacement of hardware.
.7 Controllers shall support backup and restoration of controller databases and application software.

.4 Communications
.1 Controllers shall communicate using BACnet as specified elsewhere in Division 25.
.2 BACnet controllers shall be BTL Listed.
.3 Controllers shall support peer-to-peer communication with other controllers.
.4 Controllers shall support change-of-value reporting where supported by the protocol.
.5 Controllers shall provide access to all required points, alarms, schedules, trends, and system data.

.5 Operator Access
.1 All Building Controller data, alarms, schedules, trends, setpoints, and configuration information shall be accessible from the operator workstation.
.2 User permissions and security access levels shall be consistent throughout the BAS.
.3 Changes to user credentials and permissions shall automatically apply throughout the BAS network.

.6 Reliability
.1 Building Controllers shall continue operation during loss of communication with operator workstations.
.2 Failure of any Building Controller shall not impair operation of unrelated controllers.
.3 Building Controllers shall place controlled equipment into the required fail-safe condition upon controller failure where specified by the sequence of operation.

.7 Cybersecurity
.1 Building Controllers shall comply with Division 25 cybersecurity requirements.
.2 Controllers shall permit disabling of unused communication services and ports.
.3 Controllers shall not require unsupported operating systems or software for configuration, maintenance, or operation.

2.2 EQUIPMENT CONTROLLERS (EC)

.1 General
.1 Equipment Controllers (ECs) shall provide direct digital control of HVAC, hydronic, refrigeration, heat recovery, plumbing, and electrical systems as indicated on the drawings and specified herein.
.2 Equipment Controllers shall provide all monitoring, alarming, trending, scheduling, interlocking, optimization, and control functions required to execute the specified sequences of operation.
.3 All points associated with a single piece of equipment or system shall be assigned to the same controller wherever practical.

.2 Controller Requirements
.1 Controllers shall be fully programmable, microprocessor-based devices specifically designed for building automation applications.
.2 Controllers shall support analog inputs (AI), analog outputs (AO), digital inputs (DI), and digital outputs (DO) as required by the application.
.3 Provide sufficient input/output capacity to support all specified points and required future expansion.

.4 Controllers shall support local execution of all control sequences, alarms, trends, schedules, and interlocks associated with the controlled equipment.
.5 Controllers shall execute all control functions independently of Building Controllers, operator workstations, or other network devices.
.6 Loss of communication with Building Controllers, operator workstations, or other controllers shall not impair local control operation.
.7 Controllers shall retain all programs, schedules, alarms, trends, setpoints, and configuration data through power interruptions without requiring reloading.
.8 Controllers shall automatically resume normal operation following restoration of power.

.3 Input/Output Requirements
.1 Analog Inputs shall support the required signal types including:
.1 4-20 mA.
.2 -10 VDC.
.3 Resistance temperature sensors and thermistors.
.4 Other signal types as required by the application.
.4 Include power supplies for operation of LCU and associated field equipment.
.5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.
.6 Provide conveniently located screw type or spade lug terminals for field wiring.
.7 LCU to have 25% space input and 25% output point capacity without addition of cards, terminals, etc.

2.3 TERMINAL UNIT CONTROLLERS (TCUS)

.1 General
.1 Terminal Unit Controllers (TCUs) shall provide direct digital control of terminal HVAC devices including, but not limited to:
.1 Variable Air Volume (VAV) terminals.
.2 Fan-powered VAV terminals.
.3 Fan coil units.
.4 Unit ventilators.
.5 Cabinet unit heaters.
.6 Radiant heating and cooling devices.
.7 Other terminal equipment indicated on the drawings.
.1 Controllers shall be specifically designed for terminal unit applications and shall provide all control functions required by the specified sequences of operation.
.2 Controllers shall communicate with the Building Automation System using the specified BAS communication protocol.
.3 All operating parameters, alarms, setpoints, trends, and control points shall be accessible through the BAS.

.2 Functional Requirements
.1 Controllers shall perform all required control, scheduling, alarming, trending, and monitoring functions associated with the controlled terminal unit.
.2 Controllers shall support local execution of all control sequences independent of supervisory devices.
.3 Controllers shall continue operation during loss of communication with Building Controllers, operator workstations, or other BAS devices.
.4 Controllers shall retain all programs, schedules, setpoints, alarms, trends, and configuration data during power interruptions.
.5 Controllers shall automatically resume normal operation following restoration of power.

.3 VAV Terminal Controllers
.1 VAV controllers shall be specifically designed for VAV terminal applications.

.2 Controllers shall include integral airflow measurement capability or shall interface with airflow sensing devices required for the application.
.3 Controllers shall execute airflow and temperature control algorithms required to maintain occupied and unoccupied operating conditions.
.4 Controllers shall support pressure-independent airflow control where required by the sequence of operation.
.5 Controllers shall support heating, cooling, ventilation, airflow reset, occupancy control, and other functions specified for the terminal unit.
.6 Controllers shall provide inputs and outputs required to support all associated sensors, actuators, and terminal unit accessories.

.4 Damper Actuators
.1 Provide factory-mounted or field-mounted actuators suitable for the terminal unit application.
.2 Actuators shall be sized to provide reliable operation under all operating conditions.
.3 Actuator position shall be available for monitoring through the BAS where required.

.5 Communications
.1 Controllers shall communicate directly with the BAS network.
.2 Controllers shall support peer-to-peer data sharing where required by the sequence of operation.
.3 Controller point names, alarms, schedules, trends, and setpoints shall conform to Division 25 naming and integration requirements.

.6 Reliability
.1 Failure of communications shall not affect local control functionality.
.2 Failure of unrelated BAS devices shall not impair operation of the terminal unit controller.
.3 Controllers shall place outputs in the appropriate fail-safe condition as required by the sequence of operation and controlled equipment.

2.4 SOFTWARE

.1 General.
.1 Provide all software, programming, databases, firmware, templates, and configuration tools required for a complete and operational Building Automation System.
.2 Provide all controller programming required to implement the sequences of operation specified herein.
.3 Software shall support online modification of schedules, setpoints, alarm limits, control parameters, trends, and other user-adjustable operating values without interruption of normal system operation.
.4 Software, application programs, schedules, alarms, trends, setpoints, and configuration data shall be retained during power interruptions.

.2 Programming
.1 Controllers shall be fully programmable using manufacturer-supported programming tools.
.2 Programming shall be modular and structured to facilitate future modifications, troubleshooting, and expansion.
.3 Control logic shall support:
.1 Two-position control.
.2 Floating control.
.3 PID control.
.4 Sequencing.
.5 Interlocking.
.6 Reset strategies.
.7 Mathematical calculations.

.8 Runtime accumulation.
.9 Event counting.
.10 Time-based functions.

.4 Owners shall have access to controller programming, configuration databases, and application software as specified elsewhere in Division 25.

.3 Virtual Points and Calculations
.1 The BAS shall support virtual, calculated, and software-generated points.
.2 Virtual points may utilize data from local controllers, network controllers, integrated systems, and BAS calculations.
.3 Virtual points shall support alarming, trending, scheduling, reporting, and graphical display functions equivalent to physical points.

.4 Alarms and Events
.1 The BAS shall support system-wide alarm generation, routing, prioritization, acknowledgement, and reporting.
.2 Alarm generation shall utilize management-by-exception principles to minimize nuisance alarms and prevent cascading alarms resulting from a common initiating event.
.3 Alarm priorities, routing requirements, and notifications shall be as specified elsewhere in Division 25 and the sequences of operation.

.5 Scheduling and Energy Management
.1 The BAS shall support:
.1 Time-of-day scheduling.
.2 Calendar scheduling.
.3 Holiday scheduling.
.4 Temporary overrides.
.5 Optimum start/stop.
.6 Night setback/setup.
.7 Equipment rotation.
.8 Demand limiting.
.9 Reset strategies.
.10 Demand Control Ventilation (DCV)
.11 Other energy management functions specified in the sequences of operation.
.2 Energy management functions shall execute automatically without operator intervention unless otherwise specified.

.6 Data Collection and Totalization
.1 The BAS shall support runtime accumulation, event counting, and totalization of selected analog and binary points.
.2 Users shall be able to trend, report, and display accumulated values through the BAS.
.3 Totalized values shall support user-defined engineering units and alarm thresholds.

.7 Backup and Recovery
.1 Software, databases, application programs, controller configurations, graphics, trends, and schedules shall be capable of backup and restoration.
.2 Restoration of backups shall permit recovery of system operation without reprogramming controllers.

2.5 BAS DATA PRESENTATION AND POINT NAMING

.1 Data Presentation
.1 The BAS shall provide access to all authorized points, systems, equipment, trends, alarms, schedules, and graphics through the operator workstation.
.2 Users shall be capable of viewing information at the following levels:
.1 ndividual point.
.2 Equipment level.
.3 System level.

.4 Building level.
.5 Network level.

.3 Analog values shall be displayed using appropriate engineering units and decimal precision suitable for the measured variable.
.4 Point values, equipment status, alarms, trends, schedules, and calculated values shall be updated automatically.
.5 Alarm conditions shall be clearly distinguishable from normal conditions using colour, symbols, alarm states, or other graphical indicators.
.6 Data updates shall utilize change-of-value reporting, event-driven updates, polling, or a combination thereof as supported by the BAS architecture.

.2 Point Naming
.1 Controllers shall support the BAS point naming convention specified elsewhere in Division 25.
.2 Point names shall be consistent throughout all controllers, operator workstations, graphics, alarm displays, trend logs, schedules, and reports.
.3 Point names shall remain editable by authorized users without requiring controller replacement or software modification.

3 Execution

3.1 CONTROLLER LOCATION

.1 Locate controllers to provide safe access for operation, commissioning, troubleshooting, maintenance, and future expansion.
.2 Locations shall be coordinated with architectural, structural, mechanical, and electrical systems.
.3 Final controller locations shall be submitted for Consultant review.

3.2 INSTALLATION

.1 Install controllers in manufacturer-approved enclosures or control panels.
.2 Provide dedicated power supplies and branch circuit connections as required for proper operation.
.3 Install controllers in readily accessible locations and protect from mechanical damage, moisture, excessive vibration, dust, and temperature extremes.
.4 Provide lockable enclosures for controllers installed in public or unsecured areas.
.5 Provide surge protection for controller power supplies, communication networks, and field wiring in accordance with Division 25 requirements.
.6 Provide UPS power and emergency power connections where specified or where required for continuity of critical BAS functions.
.7 Install equipment in accordance with manufacturer's recommendations and applicable codes.

END OF SECTION

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1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Control devices integral to the Building Energy Monitoring and Control System (EMCS): transmitters.

1.2 RELATED SECTIONS

.1 Section 07 84 00 - Firestopping.
.2 Section 23 09 43 - Pneumatic Control System for HVAC.
.3 Section 23 33 15 - Dampers - Operating.
.4 Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning.
.5 Section 25 05 01 - EMCS: General Requirements.
.6 Section 25 05 02 - EMCS: Submittals and Review Process.
.7 Section 25 05 03 - EMCS: Project Record Documents.
.8 Section 25 05 54 - EMCS: Identification.
.9 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.
.10 Section 26 05 00 - Common Work Results - Electrical.
.11 Section 26 27 10 - Modular Wiring System.
.12 Section 26 27 26 - Wiring Devices.

1.3 REFERENCES

.1 American National Standards Institute (ANSI).
  .1 ANSI C12.7, Requirements for Watthour Meter Sockets.
  .2 ANSI/IEEE C57.13, Requirements for Instrument Transformers.
.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM B148, Specification for Aluminum-Bronze Sand Castings.
.3 National Electrical Manufacturer's Association (NEMA).
  .1 NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
.4 Air Movement and Control Association, Inc. (AMCA).
  .1 AMCA Standard 500-D, Laboratory Method of Testing Dampers For Rating.
.5 Canadian Standards Association (CSA).
  .1 CSA-C22.1, Canadian Electrical Code, Safety Standard for Electrical Installations.

1.4 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.
  .1 Include informaction as specified for each device.
  .2 Include manufacturer's detailed installation instructions.
.2 Pre-Installation Tests.
  .1 Submit samples at random from equipment shipped, as requested by Consultant, for testing before installation. Replace devices not meeting specified performance and accuracy.
.3 Manufacturer's Instructions:
  .1 Submit manufacturer's installation instructions for specified equipment and devices.

1.5 CLOSEOUT SUBMITTALS

.1 Submit operating and maintenance data, for inclusion in the Operations and Maintenance Manual, in accordance with Section 25 05 03 - EMCS: Project Record Documentation.

2 Products

2.1 GENERAL

.1 Provide control devices of each category from a single manufacturer unless otherwise specified.

.2 Devices shall be constructed of corrosion-resistant materials and designed for durability under normal operating conditions, including resistance to vibration, temperature variation, and humidity.

.3 Devices shall be rated for operation within ambient conditions of 0-50°C and 10-90% RH (non-condensing), unless otherwise required for the application.

.4 Provide field wiring terminations suitable for the installation, including screw or spring type terminal blocks within accessible enclosures.

.5 Devices shall be designed and installed to operate without degradation of performance due to electromagnetic interference (EMI) and radio frequency interference (RFI) generated by building electrical systems, wireless devices, VFDs, and other common sources.

.6 Select and apply sensors and control devices to account for accuracy, response time, hysteresis, and operating limits appropriate for the application.

.7 Provide devices suitable for outdoor installation where indicated. Enclosures to be rated minimum CSA Type 4X (or equivalent).

.8 Devices installed in occupied spaces shall not produce objectionable audible noise under normal operating conditions.

.9 Devices shall be suitable for integration within the building automation system and compatible with specified communication protocols and with the DDC controller input type.

.10 Provide sensing devices with integral signal conditioning as required for the application.

.11 Provide factory-calibrated devices. Field calibration shall not be required except where recommended by the manufacturer or where required for system commissioning.

.12 Devices used for safety interlocks shall be listed or approved for the intended service and shall fail to a safe condition upon loss of power, communication, or device failure, unless otherwise required by the application.

.13 Provide all required interface devices to integrate with existing equipment, including signal conversion, relays, and auxiliary components.

.14 Network-connected devices shall support the cybersecurity requirements specified elsewhere in Division 25 and shall not require unsupported operating systems or software for configuration or operation.

.15 Devices with digital communications shall be compatible with the specified network architecture and communication protocol without requiring proprietary gateways unless specifically indicated.

.16 Provide all devices with terminal covers, weatherproofing, mounting brackets, guards, wells, fittings, tubing, and accessories required for a complete and operational installation.

2.2 TEMPERATURE SENSORS/TRANSMITTERS

.1 Performance Requirements

- .1 Sensors shall maintain accuracy within specified limits under normal operating conditions.
- .2 Devices shall be suitable for continuous operation within the environmental conditions of the installation.
- .3 Provide stable output with minimal sensitivity to power supply variation.

.2 Sensing Element

- .1 Sensors shall be one of the following as required by the EMCS:
  - .1 Platinum RTD, 1000 ohm at 0°C, coefficient of resistivity of 0.00385 ohms/ohm/°C or
  - .2 10k ohm thermistor.
- .2 Minimum combined sensor and transmitter accuracy of ±0.2°C unless otherwise indicated.

.3 Sensors shall have long-term stability suitable for HVAC applications with minimal drift over the service life.

.3 Output Signals
- .1 Provide output signals compatible with the controller, one of the following is required:
  - .1 Passive resistance (RTD or thermistor)
  - .2 0-10 VDC
  - .3 4-20 mA
  - .4 BACnet communication (where specified)

.4 Sensor Types
- .1 Room Sensors
  - .1 Wall-mounted with ventilated enclosure.
  - .2 Provide LCD display, setpoint adjustment and override function where indicated.
  - .3 Provide tamper-resistant guard where required.
- .2 Duct Sensors - General Purpose
  - .1 Suitable for installation in any orientation without affecting accuracy or response.
  - .2 Minimum insertion length: 300 mm unless indicated otherwise.
- .3 Averaging Duct Sensors
  - .1 Flexible averaging element with minimum sensing length of 6 m.
  - .2 Suitable for installation across duct cross-section without degradation of performance.
  - .3 Provide support brackets and mounting hardware necessary to distribute the sensor evenly across the duct cross-section.
- .4 Outside Air Sensors
  - .1 Complete with radiation/weather shield to minimize solar and wind effects.
  - .2 Weatherproof construction suitable for outdoor installation.
  - .3 Provide mounting suitable for conduit connection.
  - .4 Locate sensing element within radiation shield and isolated from direct solar radiation and precipitation.
- .5 Immersion Sensors
  - .1 Spring-loaded probe with threaded fitting to suit application.
  - .2 Provide insertion length sufficient to locate the sensing element within the central third of the fluid stream.

.5 Immersion Wells
- .1 Provide threaded stainless steel thermowells for installation in piping systems.
- .2 Provide and utilize heat transfer compound compatible with sensor.
- .3 Insertion length as required to meet immersion sensor depth.
- .4 Thermowells shall permit sensor removal without draining the piping system.
- .5 Provide pressure and temperature ratings suitable for the service.

.6 Installation Accessories
- .1 Provide mounting brackets, conduit adapters, shields, wells, guards, fittings, and accessories required for a complete installation.
- .2 Sensors installed in mechanical equipment or ductwork shall be readily accessible for service and replacement.

2.3 HUMIDITY SENSORS/TRANSMITTERS

.1 Performance Requirement
- .1 Sensors shall be capable of measuring from 5% to 95% RH minimum.
- .2 Maximum combined sensor and transmitter accuracy:
  - .1 Room Sensors: +/- 2% RH maximum
  - .2 Duct Sensors: +/- 3% RH maximum
- .3 Devices shall be suitable for ambient temperatures from 0 to 60°C unless otherwise required.

.4 Outdoor sensors shall be rated for extended temperature ranges as required by the application.
.5 Sensors shall be designed for long-term stability and minimal calibration requirements.

.2 Output Signals
.1 Provide output signals compatible with the controller, one of the following is required:
.1 0-10 VDC
.2 4-20 mA
.3 BACnet communication (where specified)

.3 Sensing Element
.1 Humidity sensing elements shall be solid-state capacitive polymer type.
.2 Sensors shall be temperature compensated to maintain specified accuracy throughout the operating range.
.3 Sensors shall be resistant to contamination, condensation, and normal HVAC operating environments.

.4 Construction
.1 Duct Sensors
.1 Probe suitable for installation in air ducts with sensing element exposed to airflow.
.2 Provide replaceable filter where required by manufacturer.
.2 Room Sensors
.1 Wall-mounted within ventilated enclosure.
.3 Outdoor Sensors
.1 Provide weatherproof construction suitable for exterior installation.
.2 Locate sensing element within a radiation shield and protected from direct solar radiation, precipitation, and standing water.

.5 Installation and Maintenance
.1 Install sensors where airflow and environmental conditions are representative of the controlled space or airstream and away from localized heat, moisture, drafts, or other sources of measurement error.
.2 Provide devices suitable for periodic maintenance and cleaning in accordance with manufacturer's recommendations.

.6 Electrical
.1 Provide stable output with minimal sensitivity to power supply variation.
.2 Power supply shall be as required by the manufacturer and compatible with the control system.

2.4 PRESSURE AND DIFFERENTIAL PRESSURE SENSORS/TRANSMITTERS

.1 Performance Requirement
.1 Accuracy: +/- 1% of full scale maximum unless otherwise indicated.
.2 Combined effects of non-linearity, hysteresis, and repeatability shall be within +/-1% of full scale.
.3 Long-term drift shall not exceed 1% of full scale per year.
.4 Devices shall maintain performance within specified accuracy over the operating range.
.5 Sensors shall withstand a minimum overpressure condition of two times the rated operating pressure without permanent damage or loss of calibration.
.6 Sensors shall permit field zero adjustment where recommended by the manufacturer.
.7 Provide field-selectable or configurable measurement ranges where available.
.8 Differential pressure sensors used for airflow, filter monitoring, or room pressurization applications shall include integral or remote zero adjustment capability.

.2 Output Signals
.1 Provide output signals compatible with the controller, one of the following is required:
.1 0-10 VDC

.2 4-20 mA
.3 BACnet communication (where specified)

.3 Construction
.1 General Pressure Sensor
.1 Provide sensing element suitable for the application (e.g., diaphragm, piezoresistive or equivalent).
.2 Wetted materials shall be compatible with the measured media.
.3 For air applications, provide barbed, compression, or push-fit pressure connections suitable for the specified tubing.
.4 For liquid applications, provide threaded pressure connections suitable for installation in the piping system.
.2 Differential Pressure Sensor - Non-Liquids
.1 Suitable for measurement of duct static pressure, filter differential pressure, and airflow applications.
.2 Provide sensor ranges appropriate to the application and pressure range.
.3 Provide averaging static pressure tips, probes, or pickup devices as appropriate for the application.
.3 Differential Pressure Sensor - Liquids
.1 Suitable for measurement of liquid pressure or liquid differential pressure.
.2 Provide sensor ranges appropriate to the fluid, measured pressure range, and operating pressure.
.3 Provide isolation and equalization valves to permit servicing, zero verification, and calibration without removing the transmitter from service.
.4 Pressure-containing components shall be rated for the maximum operating pressure of the system.
.4 Low Differential Pressure Sensors
.1 Suitable for measurement ranges as low as 0-50 Pa.
.2 Provide high sensitivity and resolution at low pressure ranges.

.4 Display
.1 Provide local LCD where indicated or required for commissioning and troubleshooting.

.5 Installation and Maintenance
.1 Install sensors in accordance with manufacturer's recommendations.
.2 Install sensors in representative locations for the measurement application.
.3 Provide tubing, fittings, brackets, and accessories required for a complete installation.

.6 Electrical
.1 Power supply shall be as required by the manufacturer and compatible with the control system.

2.5 CO2 SENSORS/TRANSMITTERS

.1 Performance Requirement
.1 Provide carbon dioxide (CO2) sensing devices for monitoring indoor air quality and control of ventilation systems.
.2 Accuracy: +/- 50 PPM + 3% of reading or better.
.3 Minimum measurement range shall be 0-2000 ppm.
.4 Devices shall maintain calibration with minimal drift over time and include automatic baseline correction where appropriate for the application or provide an equivalent manufacturer-recommended self-calibration method.
.5 Provide temperature compensation as required for accurate measurement.
.6 Sensors shall achieve specified accuracy within the manufacturer's stated stabilization period following application of power.

.2 Output Signals
.1 Provide output signals compatible with the controller, one of the following is required:

.1 0-10 VDC
.2 4-20 mA
.3 BACnet communication (where specified)

.3 Sensor Types
.1 Sensors shall utilize non-dispersive infrared (NDIR) sensing technology and be specifically designed for indoor air quality monitoring applications.
.2 Room-mounted sensors where indicated.
.3 Duct-mounted sensors suitable for installation in return air systems where indicated.

.4 Construction
.1 Provide local display where indicated or where required for commissioning.
.2 Provide protective filter or sampling arrangement suitable for return air applications.
.3 Sensors shall respond adequately to varying occupancy levels and changing ventilation conditions without excessive lag.

.5 Installation
.1 Install sensors in accordance with manufacturer's recommendations.
.2 Install sensors in locations representative of the return air from the space.
.3 For return air applications, install sensors downstream of return air collection and upstream of outdoor-air mixing locations.
.4 Avoid locations in areas with stratified airflow, dead zones, or direct discharge from localized sources.
.5 Install in an accessible location for access for maintenance, verification, and calibration.

.6 Electrical
.1 Power supply shall be as required by the manufacturer and compatible with the control system.

.7 Demand Control Ventilation (DCV) Requirements
.1 CO2 sensors shall be used to modulate the outdoor air ventilation in response to space occupancy.
.2 Sensor accuracy and stability shall be suitable to support reliable ventilation control without excessive hunting or instability.
.3 Provide sensor placement and quantity as required to represent the served space conditions.

2.6 DUCT STATIC PRESSURE AND AIRFLOW MEASUREMENT DEVICES

.1 Performance Requirements
.1 Fan static pressure sensor accuracy: +/-1% of full scale or better.
.2 Airflow measurement accuracy shall be ±2% of reading or better over the operating range.
.3 Combined effects of non-linearity, hysteresis, and repeatability shall be within +/-1% of full scale.
.4 Devices shall provide stable output with minimum drift over time.
.5 Pressure loss shall not exceed 125 Pa at design airflow unless otherwise indicated.
.6 Airflow sensing devices pressure loss shall be minimized and suitable for the application.
.7 Measurement range shall be selected to suit the application and provide adequate resolution at normal operating ranges.
.8 Devices shall maintain specified accuracy over the full operating airflow range including minimum fan speed conditions.
.9 Airflow calculations shall compensate for air density effects where required to achieve specified accuracy.

.2 Output Signals
.1 Provide output signals compatible with the controller, one of the following is required:
.1 0-10 VDC
.2 4-20 mA

.3 BACnet communication (where specified)

.3 Construction

.1 Fan System Static Pressure Sensors

.1 Provide sensing element suitable for fan control applications and environment.

.2 Where indicated, provide multipoint sensing elements with self-averaging manifold.

.2 Duct Velocity Pressure (Airflow) Sensors

.1 Airflow measurement devices shall utilize multipoint self-averaging sensing technology.

.2 Devices shall provide the accuracy specified herein under the installed airflow conditions without requiring external flow straighteners unless specifically recommended by the manufacturer.

.3 Airflow measurement devices shall be factory calibrated and supplied with calibration documentation.

.4 Airflow measurement devices shall provide repeatable measurements at reduced airflow conditions encountered during normal VFD operation.

.3 General

.1 Provide complete assemblies including, but not limited to, sensing probes, manifolds, tubing, enclosures, and mounting hardware.

.2 Provide local LCD display where indicated for commissioning and troubleshooting.

.4 Installation and Maintenance

.1 Install sensors in accordance with manufacturer's recommendations.

.2 Locate sensing elements to minimize the effects of turbulence and non-uniform airflow.

.3 Provide accessories, tubing, supports, brackets, manifolds, isolation fittings, and mounting hardware required for a complete installation.

.4 Locate sensors in accordance with manufacturer-recommended upstream and downstream straight duct requirements.

.5 Electrical

.1 Power supply shall be as required by the manufacturer and compatible with the control system.

2.7 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

.1 Performance Requirement

.1 Provide field-adjustable setpoint and differential unless fixed settings are specifically required by the application.

.2 Switching accuracy shall be ±2% of full scale or better.

.3 Devices shall withstand overpressure conditions of at least two times the rated operating pressure without permanent damage or loss of calibration.

.4 Provide devices suitable for system operating pressures as follows:

.1 Chilled and condenser water: minimum 860 kPa

.2 Hot water: minimum 860 kPa

.3 High temperature hot water: minimum 2700 kPa

.4 Duct/fan applications: suitable for 0 to 3000 Pa range

.5 Pressure-containing components shall be rated for the maximum operating pressure and temperature of the service.

.5 Devices shall be automatic reset unless manual reset is indicated or required by code, equipment manufacturer, or application.

.6 Manual-reset devices shall require local operator intervention to restore operation following a trip condition.

.7 Devices shall be suitable for the environmental conditions of the installation location, including temperature, humidity, vibration, and exposure conditions.

.8 Switch status shall be capable of direct monitoring by the DDC system where indicated.

.2 Construction
- .1 Provide sensing element suitable for the application (e.g., diaphragm or equivalent).
- .2 Provide snap-action switching suitable for reliable operation.
- .3 Switch contacts shall be rated for the connected load and minimum electrical life specified by the manufacturer.
- .4 Provide visible setpoint scale, indication, or adjustment reference suitable for commissioning and maintenance.

.3 Installation Requirements
- .1 Provide isolation valves and snubbers where required and permitted by code.
- .2 Isolation valves shall permit removal or replacement of the device without draining the system.
- .3 For steam and high temperature service, provide pigtail siphons.
- .4 Install devices to ensure accurate sensing and reliable operation.
- .5 Install devices per manufacturer's recommendations.
- .6 Switches shall be selected and wired to provide fail-safe operation appropriate to the application.

.4 Electrical
- .1 Provide switch contacts suitable for the application, including control circuit and/or line voltage switching as required.
- .2 Devices shall be suitable for connection to both DDC systems and hardwired safety circuits where indicated.
- .3 Switches shall provide SPDT contacts unless otherwise required.

2.8 TEMPERATURE SWITCHES

.1 Performance Requirement
- .1 Provide adjustable setpoint and differential suitable for the application.
- .2 Provide adjustable setpoint and differential suitable for the application.
- .3 Switching accuracy shall be within ±1°C of setpoint unless otherwise indicated.
- .4 Devices shall automatically reset unless manual reset is indicated or required by code, equipment manufacturer, or application.
- .5 Provide manual reset where required for safety applications, including:
  - .1 Freeze protection (where indicated)
  - .2 Fire protection interlocks
  - .3 Electric duct heater high-limit protection
- .6 Switches shall provide SPDT contacts unless otherwise required.

.2 Construction
- .1 Provide sensing element suitable for the application (e.g., capillary, bimetallic, or equivalent).
- .2 Provide snap-action switching suitable for reliable operation.
- .3 Switches shall provide SPDT contacts unless otherwise required.

.3 Sensor Types
- .1 Room Type
  - .1 Wall mounted on standard electrical box.
  - .2 Provide protective guard where indicated.
- .2 Duct Type
  - .1 Insertion type suitable for duct installation
  - .2 Insertion length shall position the sensing element within the active airstream.
- .3 Immersion Type
  - .1 Provide stainless steel thermowell with compression fitting.
  - .2 Insertion length suitable for the application.
  - .3 Thermowell shall permit removal and replacement of sensing element without draining the piping system.

.4 Freeze Protection Type
- .1 Continuous sensing element with minimum length of 6 m.
- .2 Capable of detecting temperature drop over any portion of sensing length.
- .3 Provide capillary sensing element arranged to monitor the full coil face area.
- .4 Freeze protection devices shall be manual reset unless otherwise indicated.

.5 Strap On Type
- .1 Provide adjustable clamp and conductive interface material suitable for secure mounting and accurate sensing.

.6 Installation Requirements
- .1 Provide thermowells, fittings, and accessories as required for complete installation.
- .2 Install devices to ensure accurate sensing and reliable operation.
- .3 Install devices per manufacturer's recommendations.

.7 Electrical
- .1 Provide switch contacts suitable for the application, including control circuit and/or line voltage switching as required.
- .2 Devices shall be suitable for connection to both DDC systems and hardwired safety circuits where indicated.

2.9 LEVEL SWITCHES

.1 Performance Requirement
- .1 Provide level switches suitable for the application. Float-operated switches shall be used unless otherwise indicated.
- .2 Devices shall provide reliable operation under expected operating conditions.
- .3 Devices shall provide sufficient differential to prevent short cycling and nuisance operation
- .4 Switches shall be selected and arranged to provide fail-safe operation where required.

.2 Construction
- .1 Provide sealed, waterproof enclosures suitable for immersion in the measured liquid.
- .2 Provide complete assembly including float, cable, and weight.
- .3 Materials shall be compatible with the liquid being measured.
- .4 Devices shall be suitable for continuous immersion and environmental conditions associated with the installation.

.3 Installation Requirements
- .1 Install switches clear of incoming flow streams, pump suction turbulence, and obstructions that could interfere with float movement.
- .2 Provide mounting and accessories required for complete installation.
- .3 Install switches clear of turbulence, incoming flow streams, and obstructions that could affect operation.
- .4 Provide separate switches for pump control and alarm functions unless otherwise indicated.

.4 Electrical
- .1 Provide normally open and/or normally closed contacts as required for the application.
- .2 Contacts shall be suitable for control circuit or line voltage switching as required.
- .3 Contacts shall be rated for the connected load.
- .4 Level switch status shall be capable of monitoring by the DDC system where indicated.

2.10 PRESSURE GAUGES

.1 Diameter: 100 mm minimum within mechanical rooms

.2 Gauges shall be sized and ranged appropriately for the application and suitable for the installation environment.

.3 Accuracy shall be suitable for the application and not less than ±2% of full scale..
.4 Gauges shall incorporate a means of isolation and service without draining the system where installed on liquid systems.

2.11 CONTROL RELAYS

.1 Provide control relays as required for signal isolation, interposing, and equipment interface.
.2 Relays shall be suitable for the application including coil voltage and contact ratings.
.3 Provide visual status indication where used for control or troubleshooting purposes.
.4 Provide contacts rated for the connected load.
.5 Provide SPDT contacts unless otherwise required.
.6 Relays shall be mounted in accessible locations within control panels or approved enclosures.

2.12 CURRENT SENSORS/TRANSDUCERS

.1 Provide current sensing devices to monitor electrical load and produce a proportional output signal.
.2 Minimum accuracy shall be +/- 0.5% of full scale.
.3 Devices shall be selected to suit the full load current of the monitored equipment and provide adequate resolution at normal operating conditions.
.4 Provide field-adjustable or configurable range as required for the application.
.5 Provide output signals compatible with the controller, one of the following is required:
.1 0-10 VDC
.2 4-20 mA
.6 Provide split-core type sensors to allow installation without disconnecting conductors.
.7 Provide mounting suitable for installation within motor control centers (MCCs), starts, or control panels.
.8 Devices shall provide true RMS measurement suitable for non-sinusoidal loads including VFD-driven equipment.
.9 Sensors shall provide electrical isolation between monitored conductors and output circuitry.
.10 Devices shall not require interruption of monitored conductors for installation.

2.13 CURRENT SENSING RELAYS

.1 Provide current sensing relays for status monitoring of motors and driven equipment, including detection of loss of load, belt failure, or motor failure.
.2 Provide adjustable trip point suitable for the application.
.3 Devices shall detect abnormal current conditions and provide output indication.
.4 Provide split-core current sensing.
.5 Provide integral status indication (LED or equivalent).
.6 Devices shall be suitable for single phase or three phase applications.
.7 Provide construction suitable for mounting within control panels or enclosures.
.8 Provide output contacts suitable for control system integration.
.9 Contacts shall be rated for the intended operation.
.10 Devices shall be powered from available control circuits as required by the manufacturer.
.11 Provide adjustable time delay where required to prevent nuisance operation during equipment startup.
.12 Devices shall utilize true RMS sensing suitable for VFD-driven motors.

2.14 CONTROL DAMPERS

.1 Supplied by Division 23 Contractor.

2.15 ELECTRONIC CONTROL DAMPER ACTUATORS

.1 Actuators to accept modulating control signal compatible with the DDC system.
.2 Provide fail position as indicated on drawings, specified in control sequences, or required by applicable codes.

.3 Actuators to be sized to operate dampers under maximum system pressure and dynamic conditions.
.4 The stroke time shall be per the following:
.1 Normal applications: maximum 120 seconds for full stroke.
.2 Emergency and generator applications: 35 seconds for full stroke.
.5 Provide direct-coupled actuators suitable for mounting on damper shafts.
.6 Provide mounting hardware required for a complete installation.
.7 Power supply shall be compatible with the DDC system.
.8 Actuators shall be sized to provide not less than 25% available torque above the calculated damper operating torque.
.9 Provide auxiliary position feedback where required for control, monitoring, or interlocking.
.10 Actuators shall provide means for manual positioning of the damper during commissioning and maintenance.
.11 Actuators shall be suitable for the environmental conditions of the installation location.
.12 Actuators to accept modulating control signal compatible with the DDC system.

2.16 CONTROL VALVES

.1 Performance Requirements
.1 Valve Type
.1 Provide globe valves or characterized ball valves for modulating control.
.2 Provide butterfly valves for larger sizes where indicated.
.2 Linear or equal percentage as indicated on control valve schedule.
.3 Size valves in accordance with system requirements and control valve schedule.
.4 Minimum leakage classification shall be ANSI Class IV unless otherwise indicated.
.5 Globe/ball valve rangeability shall be:
.1 NPS 2 and under: 50:1 minimum
.2 NPS 2 1/2 and larger: 100:1 minimum
.6 Butterfly valve rangeability shall be suitable for the control application.
.7 Control valves shall be selected with close-off pressure ratings suitable for the maximum differential pressure expected in service.
.8 Characterized ball valves shall provide a modified equal percentage flow characteristic suitable for modulating control service.
.2 Construction
.1 General
.1 Materials shall be suitable for the service (chilled water, heating water, steam, potable water, etc.).
.2 Provide replaceable trim components.
.3 Provide stainless steel stems
.2 Connections
.1 NPS 2 and under: threaded, union, press, or grooved
.2 NPS 2 1/2 and larger: flanged connections
.3 Butterfly Valves
.1 Per Section 23 05 26 - Butterfly Valves
.4 Provide valves complete with mounting provisions for actuators.
.5 Valve body pressure and temperature ratings shall be suitable for the system design conditions.
.3 Installation Requirements
.1 Install valves in accordance with manufacturer's recommendations.
.2 Provide proper orientation and access for maintenance.
.4 Electrical
.1 Valves shall operate smoothly and provide stable control over the full operating range.

2.17 ELECTRONIC / ELECTRIC VALVE ACTUATORS

.1 Performance Requirements
- .1 Actuators to provide open/closed or modulating control for control valves.
- .2 Actuators shall accept modulating control signals compatible with the DDC system.
- .3 Provide fail-safe position as indicated on the drawings, valve schedule, sequence of operation, or required by the application.
- .4 Provide actuator speed suitable for the control application, maximum 90 seconds unless otherwise required.
- .5 Actuators shall be sized to provide the valve manufacturer's required close-off force or torque with an adequate design margin.
- .6 Fail-safe operation may be provided by spring-return or electronic fail-safe technology.
- .7 Actuator and valve assemblies shall be furnished by a single manufacturer and factory assembled where available.

.2 Construction
- .1 Provide actuators with position indication.
- .2 Provide manual override.
- .3 Provide construction and enclosure suitable for the installed environment.
- .4 Provide auxiliary end switches or position feedback where required for sequencing, monitoring, or interlocking.

.3 Installation Requirements
- .1 Install actuators in accordance with manufacturer's recommendations.
- .2 Provide mounting hardware and linkage as required.
- .3 Power supply shall be compatible with the DDC system.
- .4 Devices shall provide stable and repeatable positioning.

2.18 PANELS

.1 Provide either free-standing or wall mounted control panels as required.
.2 Panels shall be constructed of steel with hinged, lockable door(s) all using the same key.
.3 Provide corrosion-resistant finish suitable for the installation environment.
.4 Panels shall be sized to accomodate installed equipment and allow for a minimum of 25% spare capacity for future expansion.
.5 Provide modular panels where multiple panels are required.
.6 Coordinate panel layout and placement with other trades and equipment

2.19 CONTROL WIRING

.1 Provide control wiring in accordance with Division 26.
.2 Provide wiring necessary for a complete and functional control system.
.3 Provide continuous wiring without unnecessary splices or joints.
.4 Provide shielding for analog and low-voltage signals where required to prevent interference.
.5 Use cable types appropriate for installation conditions, including plenum-rated cable where required.

2.20 INDOOR AIR QUALITY SENSOR

.1 Temperature Measurement:
- .1 -20°C to 50°C (-4°F to 122°F) with an accuracy of ±0.2°C to ±0.5°C.

.2 Relative Humidity Sensing:
- .1 10% to 90% with accuracy within ±1.8%.

.3 Carbon Dioxide (CO2) Monitoring:
- .1 Detects CO2 concentrations ranging from 400 to 2000 PPM, with accuracy levels of ±30 PPM or ±3-5% of the reading.

3 Execution

3.1 INSTALLATION

.1 Install devices so that manufacturer’s labels, certification labels, nameplates, and identification tags remain visible and legible after installation and commissioning.
.2 Install control equipment, field devices, components, panels, and accessories per manufacturer's instructions.
.3 Provide isolation between dissimilar metals where required to prevent galvanic corrosion.
.4 Support field-mounted panels, sensors, transmitters, switches, and accessories using suitable brackets, stands, or structural supports.
.5 Install wall-mounted devices securely on finished surfaces, backboards, or mounting plates as required for the application.
.6 Maintain fire ratings at penetrations. Provide firestopping in accordance with Section 07 84 00 - Firestopping.

3.2 ELECTRICAL AND COMMUNICATION WIRING

.1 Complete electrical installation in accordance with Division 26 requirements.
.2 Provide all control wiring, communication wiring, raceways, terminations, and accessories required for a complete and function EMCS system.
.3 Install control wiring separate from power wiring as required to prevent electromagnetic interference.
.4 Install communication wiring in conduit where required by code, project requirements, or installation requirements.
.5 Do not run exposed conduit in normally occupied spaces unless indicated or accepted by the Consultant.
.6 Wiring in mechanical rooms, electrical rooms, service rooms, and exposed locations shall be installed in conduit unless otherwise indicated.
.7 Size conduit to suit installed wiring and allow for future expansion. Maximum conduit fill shall not exceed code requirements.
.8 Provide continuous wiring without unnecessary splices. Where splices are required, make places only in accessible junction boxes or panels.
.9 Terminate wiring using terminal blocks or connectors suitable for conductor size, signal type, and number of terminations.
.10 Clearly identify wiring, cables, terminals, and conduits.
.11 Trace existing control wiring where existing equipment is modified. Provide updated wiring schematics showing additions, deletions, and modifications for Consultant review before beginning work.

3.3 TEMPERATURE AND HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.
.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.
.3 Outdoor installation:
  .1 Protect from solar radiation and wind effects by stainless steel shields.
  .2 Install in CSA 4x enclosures.
.4 Duct installations:
  .1 Do not mount in dead air space.
  .2 Locate within sensor vibration and velocity limits.
  .3 Securely mount extended surface sensor used to sense average temperature.
  .4 Thermally isolate elements from brackets and supports to respond to air temperature only.
  .5 Support sensor element separately from coils, filter racks.
.5 Averaging duct type temperature sensors.

.1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.
.2 Wire multiple sensors in series for low temperature protection applications.
.3 Wire multiple sensors separately for temperature measurement.
.4 Use either software averaging algorithm to derive overall average for control purposes or separate inputs, based on site requirements.

.6 Thermowells: install for piping installations.
.1 Locate well in elbow where pipe diameter is less than well insertion length.
.2 Thermowell to restrict flow by less than 30%.
.3 Use thermal conducting paste inside wells.

3.4 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.
.2 Use modular multiple panels if necessary to handle all requirements, with space for additional 20% PCVor FID if applicable without adding additional panels. Space to accommodate maximum capacity of associated controls (ECU, LCU, MCU and TCU).
.3 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.
.4 Identify wiring and conduit clearly.

3.5 MAGNEHELIC PRESSURE INDICATORS

.1 Provide adjacent to fan system static pressure sensor and duct system velocity pressure sensor as reviewed by Consultant.
.2 Locations: as indicated.

3.6 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES AND SENSORS

.1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.
.1 Protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.7 I/P TRANSDUCERS

.1 Install air pressure gauge on outlet.

3.8 AIR PRESSURE GAUGES

.1 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.
.2 Install pressure gauge on output of auxiliary cabinet pneumatic devices.

3.9 IDENTIFICATION

.1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

3.10 AIR FLOW MEASURING STATIONS

.1 Protect air flow measuring assembly until cleaning of ducts is completed.

3.11 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

3.12 COMMISSIONING

.1 Refer to Section 25 08 20 - EMCS: Warranty and Maintenance.

END OF SECTION

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1 General

1.1 DESCRIPTION

.1 Furnish and install Variable Frequency Drives (VFDs) for control of HVAC fans, pumps and associated mechanical equipment as indicated..
.2 Drives shall be specifically designed and marketed for HVAC applications and shall include HVAC-specific firmware and application functionality.
.3 Drives shall be complete with all accessories, mounting brackets, communication hardware, programming software, and ancillary components required for a complete operating system.
.4 Drives shall be suitable for operation on 3-phase, 60Hz electrical systems. Voltage as indicated on schedules.

1.2 RELATED SECTIONS

.1 Division 01 - General Requirements.
.2 Division 26 - Electrical

1.3 REFERENCES

.1 Institute of Electrical and Electronic Engineers (IEEE)
  .1 Standard 519 Guide for Harmonic Content and Control.
.2 Underwriters laboratories (ULC)
  .1 UL508C Power Conversion Equipment
.3 National Electrical Manufacturer's Association (NEMA)
  .1 ICS 7.0, AC Adjustable Speed Drivers
.4 International ElectroTechnical Commission (IEC)
  .1 IEC 61800 Adjustable Speed Electrical Power Drive Systems.
.5 International Standards Organization (ISO)
  .1 ISO-9001 Quality Management Systems.

1.4 SUBMITTALS

.1 Product data sheets.
.2 Outline dimensions and weights.
.3 Wiring diagrams.
.4 Schedule of factory-installed options.
.5 Communication network integration information.
.6 SCCR ratings.
.7 Harmonic analysis demonstrating compliance with IEEE 519 requirements at the Point of Common Coupling (PCC) when requested by the Engineer.
.8 Manufacturer's installation and maintenance instructions.
.9 Commissioning and startup procedures.

1.5 QUALITY ASSURANCE

.1 Manufacturer shall maintain ISO 9001 certification.
.2 Drives shall be factory tested prior to shipment.
.3 Drives shall be ULC and CSA listed and certified for use in Canada.
.4 Printed circuit boards shall be factory tested and conformally coated.

2 Products

2.1 GENERAL

.1 Drives shall be packaged, tested and warranted by a single manufacturer.
.2 Drives shall be specifically designed for variable torque HVAC applications.

.3 Drives shall be rated for continuous operation at full load under the specified ambient conditions without derating.

2.2 ELECTRICAL RATINGS

.1 Input Voltage:
  .1 Voltage per schedules
  .2 Three phase
  .3 60Hz
.2 Overload Rating:
  .1 Minimum 110% rated output current for 60 seconds.
.3 Ambient Conditions:
  .1 0°C to 40°C continuous operation without derating.
  .2 Relative humidity up to 95%, non-condensing.

2.3 ENCLOSURE

.1 Enclosures shall be NEMA Type 1 unless otherwise indicated.
.2 NEMA Type 12 enclosures shall be provided where identified on the drawings or in mechanical rooms.

2.4 SHORT CIRCUIT CURRENT RATING

.1 Drive assemblies shall have a minimum SCCR of 65 kA RMS symmetrical at 600V or greater where required by the available fault current.
.2 SCCR shall be clearly identified on shop drawings and equipment labels.

2.5 HARMONIC PERFORMANCE

.1 The Contractor shall provide a complete harmonic analysis for the project.
.2 The completed installation shall comply with IEEE 519 requirements at the Point of Common Coupling.
.3 Harmonic mitigation methods may include:
  .1 Integral DC chokes
  .2 AC line reactors
  .3 Passive harmonic filters
  .4 Active harmonic filters
  .5 Ultra-Low Harmonic drives
  .6 Active Front End drives
.4 Harmonic mitigation shall be selected by the manufacturer as necessary to achieve compliance.

2.6 COMMUNICATIONS

.1 Drives shall include native BACnet IP/MSTP communications.
.2 External communication gateways shall not be permitted unless approved by the Consultant.
.3 The drive shall communicate, as a minimum, the following points:
  .1 Run status
  .2 Speed command
  .3 Speed feedback
  .4 Frequency
  .5 Output current
  .6 Motor power (kW)
  .7 Energy consumption (kWh)
  .8 Fault indication
  .9 Active alarms
  .10 Runtime hours

2.7 CYBERSECURITY

.1 Ethernet-connected drives shall support current manufacturer cybersecurity recommendations.

.2 Drives shall provide:

- .1 Password-protected access
- .2 User access levels
- .3 Configuration backup and restore
- .4 Audit logging of parameter changes
- .5 Firmware update capability

.3 Unused communication services shall be capable of being disabled.

2.8 SAFETY

.1 Drives shall incorporate integrated Safe Torque Off (STO).

.2 STO shall comply with:

- .1 IEC 61800-5-2
- .2 SIL 2 minimum
- .3 Performance Level d minimum

.3 External contactors shall not be required to implement STO functionality.

2.9 FEATURES

.1 The following features shall be provided as standard:

- .1 Flying start capability.
- .2 Automatic restart following programmable faults.
- .3 Underload or broken-belt detection.
- .4 Loss of reference signal detection.
- .5 Overcurrent protection.
- .6 Ground fault protection.
- .7 Overvoltage protection.
- .8 Undervoltage protection.
- .9 Motor thermal protection.
- .10 Phase loss protection.
- .11 PID control capability.
- .12 Sleep mode and wake-up functions.
- .13 Firefighter Override mode where required by application.
- .14 Real-time clock for event and fault logging.
- .15 Time and date stamped fault history.
- .16 Trend and operational data logging.

2.10 OPERATOR INTERFACE

.1 Drives shall be provided with a graphical keypad.

.2 The keypad shall provide:

- .1 Hand-Off-Auto operation
- .2 Local/Remote control
- .3 Parameter programming
- .4 Parameter backup and restore
- .5 Fault acknowledgement
- .6 Diagnostic information

2.11 INPUTS/OUTPUTS

.1 Minimum onboard I/O shall include:

- .1 Two (2) programmable analog inputs.
- .2 Two (2) programmable analog outputs.
- .3 Six (6) programmable digital inputs.
- .4 Three (3) programmable Form-C relay outputs.

.2 Outputs shall be suitable for BAS integration and equipment interlocking.

2.12 ENERGY MONITORING

.1 Drives shall provide the following points through both the keypad and BAS integration:
- .1 Frequency
- .2 Current
- .3 Voltage
- .4 Motor power (kW)
- .5 Energy consumption (kWh)
- .6 Runtime hours
- .7 Load percentage

.2 Data shall be retained through power loss.

2.13 ACCEPTABLE MANUFACTURERS

.1 Acceptable manufacturers:
- .1 Danfoss FC-102 HVAC Drive
- .2 ABB ACH580 HVAC Drive
- .3 Approved equal

.2 Approved alternate manufacturers shall demonstrate compliance with all functional and performance requirements of this specification.

3 Execution

3.1 INSTALLATION

.1 Install drives in accordance with manufacturer's recommendations.
.2 Separate input conductors, output conductors and control wiring.
.3 All power and control wiring shall be installed in accordance with applicable electrical codes and per Div 26.
.4 Output reactors or dv/dt filters shall be provided where motor lead lengths exceed manufacturer recommendations.
.5 Mandatory load filters on all drives shall not be required.

3.2 STARTUP AND COMMISSIONING

.1 Factory-authorized startup shall be provided for each drive.
.2 Startup shall include:
- .1 Verification of wiring
- .2 Verification of overload protection settings
- .3 Communication commissioning
- .4 Functional testing
- .5 Motor rotation verification
- .6 Trend review
- .7 BAS integration verification

.3 Submit startup reports to the Consultant and Owner.

3.3 TRAINING

.1 Provide a minimum of two (2) hours of onsite training for Owner operating personnel.
.2 Training shall include:
- .1 Operator interface
- .2 Basic parameter adjustments
- .3 BAS integration
- .4 Alarm acknowledgement
- .5 Preventative maintenance
- .6 Data trending

.7 Backup and restoration of parameters

3.4 WARRANTY

.1 Provide a minimum warranty period of twenty-four (24) months from date of substantial completion.

.2 Warranty shall include:

- .1 Parts
- .2 Labour
- .3 Travel expenses
- .4 Technical support

.3 Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION

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1 General

1.1 DESIGN DOCUMENTATION

.1 Design documentation for each system to include, as a minimum:
- .1 Narrative type of Sequence of Operation.
- .2 Control Description Logic (CDL).
- .3 Input/Output Summary Schedules.
- .4 Schematics.

1.2 EMCS LANGUAGE DESIGN CRITERIA

.1 Language: refer to Section 25 05 01 - EMCS: General Requirements.

.2 Levels of EMCS Language
- .1 Level 1: alarm and operational messages to convey alarm conditions or operational messages.
- .2 Level 2: full names of equipment and control points. The various systems, their equipment and components and all control points are named in accordance with this section.
- .3 Level 3: system, equipment, component and control point descriptors: unique, alphanumeric identifiers derived from full names of corresponding system component and control point.
- .4 Level 4: commands: represent various computer functions and routines.
  - .1 Operational commands - relate to building operations and building system controls.
  - .2 Computer system commands - relate to computer maintenance, upgrading or development software used to improve and maintain the application software for the building site.
- .5 Level 5: machine language. Languages specific to each manufacturer's product, used internally to perform its functions and routines.

.3 Additional Equipment, Components and/or Control Points. Where additional equipment, components and/or control points are required on specific projects, the following procedures shall be adopted:
- .1 Full names of the equipment, component and control points shall be not more than 40 characters, including numerals.
- .2 SYSTEM descriptors shall be not more than 10 alphanumeric characters. INPUT and OUTPUT descriptors shall be not more than 10 alphanumeric characters. The letters shall be based upon the English/French language full name, and should, where possible, be the first letter of each word of the full name.

.4 The descriptor shall be unique.

.5 Descriptors and expansions: table lists standardized system identifiers and point identifiers.
- .1 Table: Identifiers and Expansions

English Identifier (10 characters max)	English Expansion
OAD	Outside air damper
OAT	Outside air temperature
OARH	Outside air relative humidity
OAH	Outside air enthalpy
RAD	Return air damper
RAT	Return air temperature
SP	Return air temperature setpoint

English Identifier (10 characters max)	English Expansion
RAH	Return air humidity
RASP	Return air static pressure
RAH	Return air enthalpy
MAD	** Mixed air dampers **
MAT	Mixed air temperature
MAPSP	Mixed air plenum static pressure
** MAD shall be used for applications where outside air and return air dampers are controlled from one (1) output signal.	
EAD	Exhaust air damper
PFPD	Pre-filter pressure drop
PFALM	Pre-filter pressure drop alarm
FFPD	Final filter pressure drop
FFALM	Final filter pressure drop alarm
HCVLV	Heating coil valve
BPD	Heating coil face and bypass damper
HCFA	Heating coil freeze alarm
SF#-	Supply fan # status
SF#-SPD	Supply fan # VFD control
SF#-FLT	Supply fan # VFD fault
SAV	Supply air volume
SAVSP	Supply air volume setpoint
SAT	Supply air temperature
SP	Supply air temperature setpoint
SARH	Supply air relative humidity
SASP	Supply air static pressure
RF#-SPD	Return fan # status
RF#-VSD	Return fan # VFD control
RF#-FLT	Return fan # VFD fault
RAV	Return air volume
RAVSP	Return air volume setpoint
RAT	Return air temperature
RARH	Return air relative humidity

English Identifier (10 characters max)	English Expansion
RASP	Return air static pressure
EF#-FLT	Exhaust fan #setpoint
EF#	Exhaust fan # fault
EXAT	exhaust air temperature
EXAV	exhaust air volume
GWP-SPD	Geothermal water pump # speed
GWP #-FLT	Geothermal water pump # fault
GWP#	Geothermal water pump # status
HTA	High temperature alarm
LTA	Low temperature alarm
HTCO	High temperature cutout
LTCO	Low temperature cutout
HLA	High level alarm
LLA	Low level alarm
HLCO	High level cutout
LLCO	Low level cutout
GWF	Geothermal water flow rate
GWST	Geothermal water supply temperature
GWRT	Geothermal water return temperature
RM-T	Room temperature
RM-RH	Room relative humidity
RM-SP	RM-SP Room static pressure (add reference point)
Examples of specific space conditions:	
RM-TNPER 2	Space temperature, North Perimeter, 2nd floor
RM-SPSPER I9	Space static pressure, South Perimeter, 19th floor
RM-HEINT 9	Space humidity, East Interior, 9th floor
AFS	Air Flow Switch
AFM	Air Flow Monitor
F	Flow
P	Pressure

English Identifier (10 characters max)	English Expansion
ST	Supply temperature
RT	Return temperature
CHW	Chilled water system
CW	Condenser Water System
HW	Hot water heating system
RAD	Radiation system
DCW	Domestic cold water system
DHW	Domestic hot water system
DHWR	Domestic hot water system Recirculation
SANP	Sanitary sewage - pumped system
STMP	Storm water - pumped system
Fire standpipe & hose system"#" denotes the numbering of equipment (e.g., HWP1, SF2, RF3, etc.)	

1.3 I/O SUMMARY SCHEDULES

.1 General:

.1 The EMCS contractor shall provide a complete I/O summary schedule similar to the one listed below, listing and describing all I/O's in detail. Contractor's standard schedule may be used provided all relevant information is provided.

.2 PCU no: identifies the PCU to which all points in the I/O Summary Schedule are wired.

.3 Building/Area: unique label given to each building forming part of a multi-building facility.

.4 Area/System Label: unique label given to each area of the building or to each system.

.1 Column 1: Point no: I/O Summary Schedule reference number.

.2 Column 2: Point label: unique label for each point in the system. Point labels may be repeated for other buildings or systems.

.3 Column 3: Description: describes the point label in expanded terms.

.4 Column 4: Type: (eg. AI, AO, DI, DO).

.5 Column 5: Eng. Units: Describes the engineering units used (eg. for AI, AO: C, kPa, Amp Volt. For DI, DO: OFF, ON).

.6 Column 6: Access level: Defines the level of access for varying complexity of functions. Usually associated with password feature. Usually assigned value between 0 (lowest) and 4 (highest).

.7 Column 7: Sensor type: describes in 2 or 3words.

.8 Column 8: Assoc. Point: Identifies/ describes points for purposes of alarm suppression, software interlocks.

.9 Column 9: Type: defines the type of alarm (eg. CR = CRITICAL, CA = CAUTIONARY, M = MAINTENANCE).

.10 Column 10: DI/DO, NO/NC: defines the NORMAL condition of alarm. (NC = NORMALLY CLOSED. NO = NORMALLY OPEN).

.11 Column 11: Limits: Defines alarm levels (eg. L2 = Low alarm, Level2. H1 = High alarm, Level1).
.12 Column 12: Alarm Mess: Defines alarm message number. This number is related to pre-composed message detailing the problem and describing the required action.
.13 Column 13: Maint Mess: defines maintenance message number. This number as related to pre-composed message detailing the problem and describing the required action.
.14 Column 14: Set Point: Defines the design set-point of the control loop.
.15 Column 15: Dead band: defines the range above or below the set-point at which no change in output signal is to occur.
.16 Column 16: Dev alarm limit: defines the limit on deviation of the measured value from the set-point (sometimes also referred to as the "error limit").
.17 Column 17: NC/NO: defines NORMAL condition when de-energized. NC - NORMALLY CLOSED. NO = NORMALLY OPEN. DA/RA: defines the form of action. DA = direct acting. RA = REVERSE ACTING.
.18 Column 18: Contacts: NO/NC: defines NORMAL condition when de-energized. NC = NORMALLY CLOSED. NO = NORMALLY OPEN.
.19 Column 19: Delay Succ starts: defines the time limits (usually in seconds). To prevent overheating of motors or equipment from frequent re-starting.
.20 Column 20: Heavy motor delay: defines the time (usually up to 60seconds). To prevent heavy electrical load from simultaneous starting of large consumption equipment.
.21 Column 21: auto-reset: A = AUTOMATIC. M=MANUAL.
.22 Column 22: Programs:
.1 Examples of Applications Programs include: Night set-back; optimum start/stop; demand limiting (load shedding).
.2 Optimization routines (eg. chiller optimization, supply air temperature optimization, enthalpy control) should be described as part of CDL's.
.3 Parameters for all application programs should be provided separately as part of the design documentation (eg. the Systems Operation Manual).
.4 Note requirements for computer totalization, recording, print-out of accumulated value of a point over a period of time. If totalization depends upon a number of analog points, include for pseudo energy points.
.5 Run time totals: for calculation of operation of digital points.
.6 Optimum start/stop: Example: HVAC unit to start before scheduled occupancy, based upon HVAC unit capacity, heat loss, interior and exterior environmental conditions, etc.

.2 Schedule:

INPUT / OUTPUT			Schedule PCU No.						(See 1.3.2)	
PROJECT NO.			Bldg / Area				NAME		(See 1.3.3)	
PROJECT NAME			Area / System				NAME		(See 1.3.3)	
POINT IDENTIFICATION									ALARMS	
1	2	3	4	5	6	7	8	9	10	11
Point.	Point	Descrip	Type	Eng.	Access	Sensor	Assoc	Type	DI/D0	Limits
No	Label			Unit	Level	type	Point	(M,CR)	NO/NC	

MESSAGES									DI/DO
12	13	14	15	16	17	18	19	20	21

Alarm Limit	Maint	Set-Point MO/MA	Dead band start	Dev. alarm delay	NO/NC DA/RA	Cont's NO/NC	Delay succ.	Heavy Motor	Auto reset

1.4 CONTROL NARRATIVE SEQUENCE OF OPERATIONS

.1 Geothermal Heat Pumps (GSHP-1 to 7):

.1 Run Conditions - Scheduled:

.1 The unit shall run according to a user definable time schedule in the following modes:

.1 Occupied Mode: The unit shall maintain

.1 A 24°C (adj.) cooling setpoint

.2 A 21°C (adj.) heating setpoint

.2 Unoccupied Mode (night setback): The unit shall maintain

.1 A 26°C (adj.) cooling setpoint.

.2 A 18°C(adj.) heating setpoint.

.2 Alarms shall be provided as follows:

.1 High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).

.2 .2 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

.3 Zone Setpoint Adjust:

.1 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

.2 A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

.4 Fan:

.1 The fan shall run anytime the unit is commanded to run, unless shutdown on safeties. The fan speed shall modulate as required to maintain zone temperature setpoint.

.5 Heating and Cooling:

.1 The controller shall measure the zone temperature and stage and modulate the compressor(s) and fan speeds as required to maintain zone temperature setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime. The compressor shall run subject to its own internal safeties and controls.

.2 The heating and cooling modes shall enable and disable as required to satisfy the zone temperature setpoints.

.3 On mode change, the compressor shall be disabled and remain off until after the reversing valve has changed position.

.4 The heat pump startup sequence shall be the following. Follow the manufacturer's recommended timing before enabling subsequent stages.

.1 Thermostat or BMS sends commend to start Heat Pump.

.2 Open heat pump control valve to allow for flow circulation.

.3 Start heat pump fan.

.4 Upon proof of sufficient flow, start the compressor and begin modulation.

.6 The heat pump shutdown sequence shall be the following. Follow the manufacturer's recommended timing before enabling subsequent stages.

.1 Thermostat or BMS sends command to stop Heat Pump

.2 Stop the compressor
.3 Stop the heat pump fan
.4 Close the pump control valve.

.7 Alarms shall be provided as follows:
.1 Compressor 1 Runtime Exceeded: Compressor 1 runtime exceeds a user definable limit (adj.).
.2 Compressor 2 Runtime Exceeded (if applicable): Compressor 2 runtime exceeds a user definable limit (adj.).

.8 Filter Differential Pressure Monitor:
.1 The controller shall monitor the differential pressure across the filter.
.2 Alarms shall be provided as follows:
.1 Filter Change Required: Filter differential pressure exceeds a user definable limit (adj.).

.9 Discharge Air Temperature:
.1 The controller shall monitor the discharge air temperature.
.2 Alarms shall be provided as follows:
.1 High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
.2 Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

.10 Fan Status:
.1 The controller shall monitor the fan status.
.2 Alarms shall be provided as follows:
.1 Fan Failure: Commanded on, but the status is off.
.2 Fan in Hand: Commanded off, but the status is on.
.3 Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

.11 Leaving Water Temperature:
.1 The controller shall monitor leaving water temperature
.2 Alarms shall be provided as follows:
.1 High Leaving Water Temp: If entering water temp is greater than 40°C (adj.) for 5 minutes or longer.
.2 Low Leaving Water Temp: If entering water temp less than -3°C (adj.) for 5 minutes or longer.

.12 Condensate Overflow Alarm:
.1 The controller shall receive condensate overflow alarm signal from heat pump control board and alarm. The heat pump shall be disabled until manually reset by operators.

.2 Well Pumps (WP-1 and WP-2)
.1 Geothermal Field Loop Monitor - Run Conditions:
.1 The loop monitor shall run whenever:
.1 P-1 or P-2 is operational

.2 Alarms shall be generated upon any of the following loop water conditions:
.1 No Loop Flow with WP-1 or WP-2 operational.
.2 High Field Loop Water Supply Temp Shutdown: If the loop water supply temperature is greater than 45°C (adj.) for 5 minutes or longer.
.3 Low Field Loop Water Supply Temp Shutdown: If the loop water supply temperature is less than 0°C (adj.) for 5 minutes or longer.

.3 Building Loop Temperature Control:
.1 Whenever P-1 or P-2 is operational the following monitoring controls will occur:
.1 Heating:
.1 If the building loop return water temperature is less than 8°C (adj.) for longer than 1 minute, open the duty heat exchanger

control valve to fully open if closed, and start the duty well pump. Modulate the heat exchanger control valve to maintain the building return water temperature above 6°C (adj.). The well pump shall modulate to maintain a differential pressure setpoint of 70 kPa (to be finalized during system commissioning). The well pump shall not operate below 30% speed.

.2 If the return water temperature is above 8°C for longer than 5 minutes, stop the duty pump and close the heat exchanger source (well water) control valve.

.2 Cooling:

.1 If the building loop return water temperature is greater than 27°C (adj.) for longer than 3 minutes, open the duty heat exchanger source (well water) control valve to fully open if closed. Modulate the heat exchanger control valve to maintain the building return water temperature below 27°C (adj.). Modulate the well pump speed to maintain the differential pressure setpoint of 70 kPa (to be finalized during commissioning). The pump shall not operate below 30% speed.

.2 If the building loop return water temperature is less than 25°C (adj.) for longer than 5 minutes, stop the duty pump.

.4 Well Pump and Heat Exchanger Duty/Standby Operation:

.1 The two well water pumps shall operate in a duty/standby fashion.

.1 The duty pump shall run.

.2 On failure of the duty pump, the standby pump shall run and the duty pump shall turn off.

.2 The designated lead pump and lead heat exchanger shall rotate upon one of the following conditions (user selectable):

.1 if runtime (adj.) is exceeded

.2 twice a week

.3 weekly

.4 monthly

.5 Alarms shall be provided as follows:

.1 Well Pump WP-1

.1 Failure: Commanded on, but the status is off.

.2 Running in Hand: Commanded off, but the status is on.

.3 Runtime Exceeded: Status runtime exceeds a user definable limit.

.4 VFD Fault.

.2 Well Pump WP-2

.1 Failure: Commanded on, but the status is off.

.2 Running in Hand: Commanded off, but the status is on.

.3 Runtime Exceeded: Status runtime exceeds a user definable limit.

.4 VFD Fault.

.6 Power Consumption:

.1 Power draw of each pump shall be trended in 15 minutes intervals and be totalized in kWh monthly and annually. The totals shall be shown on an energy consumption graphical page.

.3 Building Distribution Pumps (P-1 and P-2):

.1 Water Source Heat Pump Loop Monitor - Run Conditions:

.1 The loop monitor shall run whenever:

.1 Any zone is occupied.

.2 OR a heat pump valve is open > 5%.

.2 The following loop water conditions shall be monitored:

.1 Flow status.
.2 Supply temperature.
.3 Return temperature.
.4 Shall calculate water power or energy consumption.

.3 Alarms and a heat pump shutdown signal shall be generated upon any of the following loop water conditions:
.1 No Loop Flow.
.2 High Loop Water Supply Temp Shutdown: If the loop water supply temperature is greater than 45°C (adj.) for 5 minutes or longer.
.3 Low Loop Water Supply Temp Shutdown: If the loop water supply temperature is less than 0°C (adj.) for 5 minutes or longer.

.4 Alarms shall be provided as follows:
.1 High Loop Water Supply Temp: If the loop water supply temperature is greater than 40°C (adj.).
.2 Low Loop Water Supply Temp: If the loop water supply temperature is less than 2°C (adj.).

.5 Loop Water Pump Duty/Standby Operation:
.1 The two loop water pumps shall operate in a duty/standby fashion.
.1 The duty pump shall run.
.2 On failure of the duty pump, the standby pump shall run and the lead pump shall turn off.
.2 The designated lead pump shall rotate upon one of the following conditions (user selectable):
.1 if pump runtime (adj.) is exceeded
.2 twice a week
.3 weekly
.4 monthly
.3 Alarms shall be provided as follows:
.1 Loop Water Pump P-1
.1 Failure: Commanded on, but the status is off.
.2 Running in Hand: Commanded off, but the status is on.
.3 Runtime Exceeded: Status runtime exceeds a user definable limit.
.4 VFD Fault.
.2 Loop Water Pump P-2
.1 Failure: Commanded on, but the status is off.
.2 Running in Hand: Commanded off, but the status is on.
.3 Runtime Exceeded: Status runtime exceeds a user definable limit.
.4 VFD Fault.

.6 Loop Water Differential Pressure Control:
.1 The controller shall measure loop water differential pressure and modulate the loop water pump speed to maintain the loop water differential pressure setpoint. The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.
.2 The controller shall modulate duty loop water pump speed and bypass valve position in series to maintain a loop water differential pressure of 70 kPa (adj.). The pump minimum speed shall not drop below 30% (adj.).
.3 The controller shall modulate a PID control loop output variable from 0-100. The PID loop shall modulate the output to maintain the system differential pressure at the differential pressure setpoint of 70 kPa (adj.). The control loop output variable shall have the following control actions. The pump minimum speed shall be 30%.

Control Loop (%)	Bypass Valve (%)	Pump Speed (%)
0-30	100-0	30
30-100	0	30-100



.1 Alarms shall be provided as follows:
.1 High Loop Water Differential Pressure: If the loop water differential pressure is 25% (adj.) greater than setpoint for more than 5 minutes.
.2 Low Loop Water Differential Pressure: If the loop water differential pressure is 25% (adj.) less than setpoint for more than 5 minutes.
.2 Power Consumption:
.1 Power draw of each pump shall be trended in 15 minutes intervals and be totalized in kWh monthly and annually. The totals shall be shown on an energy consumption graphical page.

.7 Energy Recovery Ventilator (ERV)
.1 Startup
.1 The ERV shall be enabled by any of the following:
.1 Building Schedule
.2 Operator Command
.2 Upon receiving a start command the following startup sequence shall occur:
.1 Verify no active safety shutdown conditions exist
.2 Start exhaust fan
.3 After proof of exhaust fan operation, start supply fan.
.4 After proof of supply fan operation, release supply air temperature control.
.3 The EMCS shall generate an alarm if the fan proof is not received within 60 seconds.
.4 Shutdown
.1 Upon receiving a stop command, the following shutdown sequence shall occur:
.1 Stop supply fan
.2 Following a 2 minute timer, stop the exhaust fan
.3 Disable heating coil command
.5 Normal Operation
.1 The supply and exhaust fan shall run according to the building's occupancy. The supply and exhaust fan maximum speeds shall be

determined during TAB to provide the specified supply and exhaust airflows.

.2 The supply and exhaust fan speeds shall modulate to maintain a return air duct CO2 concentration to be below 1000 PPM (adj.).

.3 When the unit is operational, the ERV shall modulate the energy recovery wheel to maintain the supply air temperature at a setpoint of 8°C (adj.).

.4 The EMCS shall generate an alarm whenever the supply and/or return fan is commanded to operate and does not prove ON within 60 seconds, or when an operating fan stops while the unit is enabled.

.5 The ERV shall utilize the manufacturer's included defrost sequence.

.6 Emergency Shutdown

.1 The units may enter an emergency shutdown mode upon

.1 Fire Alarm

.2 Smoke detector

.3 Emergency stop activation

.4 Heat recovery wheel not running

.5 Freeze stat

.2 Upon a shutdown, the following sequence shall occur:

.1 Stop supply and return fans

.2 Close outdoor and exhaust air dampers

.8 Water to Water Heat Pumps

.1 The heat pump shall be enabled when:

.1 Pump P-3 is enabled

.2 Heat pump shall start/stop to maintain buffer tank temperature above 50°C.

.3 Controls system shall monitor status of both the heat pump and pump P-3. If the heat pump is detected in fault, or in operation without positive status from associated pumps, heat pump shall be shut down, and an alarm is generated.

.4 Discharge water temperature shall be monitored. If temperature is less than 5°C, system shall shut down the following components and generate an alarm:

.1 ERV

.2 P-3

.3 HP-8

.5 System shall monitor all supply and discharge temperatures.

.9 ERV Heating Coil and Pump P-3

.1 The heating coil and pump P-3 shall be enabled when the ERV is enabled.

.2 The heating coil control valve shall modulate to maintain a leaving air temperature of 18°C.

.3 The pump P-3 shall run when the heating coil control valve is open greater than 10% for 3 minutes. The pump P-3 shall stop when the heating coil control valve is less than 5% open for 3 minutes.

.4 An alarm shall be generated if pump P-3 fails to start and HP-8 shall not be permitted to start while pump P-3 is not running.

1.5 INPUT/OUTPUT POINT SUMMARY TABLE

.1 The input/output table summarizes the Input/Output (I/O) points for the various systems as outlined within the EMCS specifications and control schematic drawings. However, the tables are not all inclusive as they do not list the typical room temperature sensors, reheat coil valves, radiator valves, unit heater/force flow valves, terminal unit control assemblies, infloor heating manifold loop valves, etc. The number and location of these devices can be found on the floor plans and/or listed in relevant schedules. All points and field devices required to

accomplish the specified sequence of operation shall be provided. Any discrepancies in I/O counts between the points list, specs and drawings shall be reported to the Owner.

2 Products

2.1 NOT APPLICABLE

.1 N/A

3 Execution

3.1 NOT APPLICABLE

.1 N/A

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA C22.1-24, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
  .2 CAN3-C235-83 (R2019), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
  .3 CSA Z462-21, Workplace Electrical Safety.
.2 Institute of Electrical and Electronics Engineers (IEEE) / National Electrical Safety Code Product Line (NESC).
  .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standard Terms, 7th Edition.

1.2 DEFINITIONS

.1 Electrical terms used in electrical specifications and on electrical drawings are those defined by IEEE SP1122.

1.3 CARE, OPERATION AND START-UP

.1 Instruct Consultant and operating personnel in the operation, care and maintenance of systems, system equipment and components.
.2 Operating instructions to include following:
  .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  .2 Start up, proper adjustment, operating, maintenance, and shutdown procedures.
  .3 Safety precautions.
  .4 Procedures to be followed in event of equipment or component failure.
  .5 Other items of instruction as recommended by manufacturer of the system or equipment.
.3 Print operating instructions in laminated plastic adjacent to equipment or systems interface.
.4 Arrange and pay for manufacturer's factory service technician to supervise start-up, installation, check, adjust, balance and calibrate components and instruct operating personnel.
.5 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235-83 (R2019).
.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SITE VISIT

.1 Prior to tender submission visit the site and become familiar with the job and all conditions which may affect the overall cost. Ignorance of existing conditions will not be considered as basis for extra claims. Refer to Division 01 - General Requirements for additional information.

1.6 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .1 Submit shop drawings for all electrical equipment unless otherwise indicated.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.
.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
.4 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
.5 If changes are required, resubmit corrected shop drawings.

.2 Manufacturer's Field Reports: submit to Consultant within 7 days of review, verifying compliance of work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

.3 Provide single line electrical diagrams in glazed frames or laminated sheets as follows:
.1 Electrical distribution system: locate in main electrical room.
.2 Electrical power generation and distribution systems: locate in power plant rooms.

.4 Submit WHMIS MSDS information in accordance with Division 01 - General Requirements.

.5 Upon completion of work submit As-Built Drawings, Maintenance Manuals, and Submittals in accordance with Division 01 - General Requirements.

1.7 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Division 01 - General Requirements.

.2 All electrical work is to be carried out by qualified, licensed electricians or apprentices for the province of Prince Edward Island and the electrical contractor must have a valid contractor license issued by the province of Prince Edward Island.
.1 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 The Consultant reserves the right to approve the quality of material and workmanship, and to call for any tests which they deem necessary to establish the integrity of the installation during the progress of the work and a complete test of each system at the completion of the work. The cost of such tests are not to be considered as extras.

.4 Health and Safety: in accordance with Division 01 - General Requirements.
.1 Protect exposed live equipment during construction for personnel safety.
.2 Shield and mark all live parts “LIVE 120 VOLTS”, or with appropriate voltage in English.
.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of an electrician.

.5 Quality Control: in accordance with Division 01 - General Requirements.
.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to the authority having jurisdiction for approval before delivery to site.
.2 Submit test results of installed electrical systems and instrumentation.
.3 Upon completion of work, submit load balance report as described in PART 3 - LOAD BALANCE.
.4 Submit certificate of acceptance from authority having jurisdiction upon completion of work to Consultant.

1.8 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay all associated fees.

.3 Notify Consultant of changes required by Electrical Inspection Division prior to making changes.

.4 Submit Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Consultant.

1.9 CO-ORDINATION

.1 Co-ordinate all work with work of other divisions to avoid conflict and notify Consultant if any changes are required.

.2 Locate electrical systems, equipment, and materials to provide minimum interference and maximum usable space.

.3 Contractor to locate all existing underground services before commencing work and be responsible for any damages caused by failure to coordinate with and preserve underground services.

.4 Where interference occurs, the Consultant must approve relocation of equipment and materials regardless of installation order.

.5 Notwithstanding the review of shop drawings, the Electrical Contractor may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination of the Electrical Contractor with other trades. The cost of this relocation will be the responsibility of the Electrical Contractor and the Consultant will determine the extent of relocation required.

.6 Leave space clear, and install equipment to accommodate future materials and/or equipment as indicated or specified, or to accommodate equipment and/or materials supplied by other Contractors.

.7 Verify that the spaces in which the equipment is to be installed is sufficient and install all equipment to maintain head room and clearances, to conserve space, comply with codes, and to ensure adequate space for future servicing.

.8 The Drawings for the Electrical work are diagrammatic performance Drawings only and are intended to convey the scope of work and indicate the general arrangement, locations, and size of equipment fixtures and outlets. The Drawings do not show Architectural, Mechanical or Structural details.

.9 Do not scale or measure Drawings, but obtain information regarding accurate dimensions, from the dimensions shown on the Architectural Drawings or by site measurements. Follow the Electrical Drawings for laying out the work.

1.10 CUTTING AND PATCHING

.1 Electrical Contractor to inform all other divisions in time, of required electrical openings and/or penetrations. Where this requirement is not met, the cost of all cutting and associated work to provide openings and/or penetrations will be the responsibility of the Electrical Contractor. Obtain written approval of Structural Engineer before drilling through any beams or floors. Keep hole sizes to a minimum and be responsible to repair damage caused by lack of coordination.

1.11 DELIVERY, STORAGE AND HANDLING

.1 Provide Consultant with material delivery schedule within two weeks after award of Contract.

.2 Arrange for delivery access and unloading and/or storage areas with General Contractor.

1.12 INSPECTION OF WORK

.1 Periodic visits to the site during construction phase will take place to ascertain reasonable conformity to plans and specifications. The Contractor will be responsible for the execution of their work in conformity with the construction documents, the Contract, and the requirements of the inspection authority.

1.13 SCHEDULING OF WORK

.1 Work is to be scheduled in phases as described in Division 01 - General Requirements.

.2 Become familiar with the phasing requirements for the work and comply with these conditions.

.3 No additional monies will be paid for Contractor's requirement to comply with work phasing conditions.

.4 Note that the Owner intends to carry on business as usual and work activities must be coordinated to maintain electrical services in occupied areas. Provide any required temporary work.

.5 Work activities which disrupt occupants of the building, such as excessive noise caused by drilling of walls, floors or ceilings must be approved and scheduled in writing by the Project Manager at least 48 hours in advance.

.6 All power shutdowns which affect building occupants or building operation must have prior approval of Owner and must be scheduled in writing at least 48 hours in advance with the Project Manager.

.7 Overtime work, and work outside normal work hours deemed necessary to meet the schedule are the responsibility of the Contractor and must meet the requirements of the PEI Employment Standards Act. All costs resulting from such overtime work must be included in the Contractor's total tender price.

1.14 FIRE RATING OF PENETRATIONS

.1 Provide fire stopping and smoke seal materials at openings around cabling conduits passing through floors, ceilings and fire rated walls, as required to maintain fire rating equal to the fire rated assembly.

.2 Use ULC or approved equal fire barrier products installed in accordance with manufacturers instructions at each penetration.

.3 Acceptable material for fire barrier products to be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.

2 Products

2.1 PRIOR APPROVAL OF PRODUCTS

.1 The use of any product not listed by name in the specification must be approved by Consultant prior to tender submission.

.2 By using pre-approved product substitutions the Contractor accepts the responsibility and associated costs for all required modifications to circuitry, devices and wiring. The Contractor is to submit shop drawings with deviation from the original design highlighted to the Consultant for review and approval prior to rough-in.

2.2 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Division 01 - General Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Division prior to delivery and submit such approval as described in Part 1 - Submittals.

2.3 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.

.2 Paint indoor electrical equipment enclosures light grey to EEMAC 2Y-1.

2.4 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department.

.2 Porcelain enamel or acrylic decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 All junction and pull boxes are to be marked with an indelible ink marker to designate the circuit number of enclosed wiring, the designated panel name and electrical characteristics. Where boxes are painted in exposed areas, information is to be written on inside of box cover.

.2 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES:			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	12 x 70 mm	1 line	8 mm high letters
Size 5	12 x 70 mm	2 lines	5mm high letters
Size 6	12 x 70 mm	1 line	12mm high letters
Size 7	12 x 70 mm	2 line	6 mm high letters

.3 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by Consultant prior to manufacture.

.5 Allow for average of twenty-five (25) letters per nameplate and label.

.6 Identification to be English.

.7 Nameplates for pull boxes and junction boxes to indicate system name and voltage characteristics.

.8 Nameplates for disconnects, starters and contactors to indicate equipment being controlled, wire, voltage, phase, number of power source and branch circuit breaker number.

.9 Nameplates for pull boxes, splitters and panelboards to indicate system name, overcurrent protection device rating, voltage, phase, and number of wire, and power source.

.10 Nameplate for transformers to indicate capacity, primary and secondary voltages and transformer number.

.11 Lamicoid nameplate installed on panelboards and splitter troughs shall indicate the following:

.1 Designated name of equipment.

.2 Voltage, number of phases and wires.

.3 Designation of power source.

.4 The following is an example:

PANEL LT-24 120/208V - 3PH - 4W
FED FROM DISTRIBUTION BOARD LD-T1

.12 Lamicoid nameplates installed on combination starters, magnetic starters, manual starters and all various system controls, control panels, contactors, disconnect switches, and large junction and pull boxes shall contain the following information:

.1 Designated name of equipment.

.2 Designated name of power source.

.3 Voltage, number of phases and wires.

.4 Branch circuit breaker number(s) where possible.

.5 The following is an example:

HEAT PUMP 'HP-7' 208V-3PH, FED FROM D101-38, 40, 42

.13 Install an additional nameplate on all, or any piece of electrical equipment, or apparatus, i.e. Main Switchboard, CDP panels, panelboards, motor control centres, and fusible switches, etc., that may contain overcurrent devices, i.e. circuit breakers and/or fuses, that have been designed for, and incorporate an interrupting capacity sized "larger" than 10 KAIC.

Example:

Minimum interrupting capacity of breakers installed in this panel is to be not less than 22 KAIC	Minimum interrupting capacity of fuses installed in this switch are to be not less than 100 KAIC

2.7 WIRING IDENTIFICATION

.1 Identify wiring with indelible pre-printed self-adhesive vinyl tape, indicating panel and circuit number. Wiring to be identified at both ends and at junction, pull boxes and splices.
.2 Maintain phase sequence and colour coding throughout.
.3 Colour code: to CSA C22.1-24, Canadian Electrical Code.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.
  .1 Colour coding of electrical boxes and their associated covers located in finished areas to be applied to the inside cover and box.
.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.
  .1 Colours indicated below are for reference only. If an existing colour coding scheme exists within the building, then the existing colour coding scheme is to be utilized.

SYSTEM	PRIME COLOR	AUXILIARY COLOR
208/120V (normal)	Yellow	-------
Telephone	White	-------
Data	Blue	-------
Fire Alarm	Red	-------
Access Control	Black	-------
CCTV	Purple	-------
WAP	Yellow	-------
Intrusion Alarm	Grey	-------

3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.2 FIRE STOPPING

.1 In walls requiring a fire-resistance rating, where outlets are on opposite sides within a single stud cavity or within 600 mm of one another measured horizontally (150 mm minimum back-to-back separation); or where the area of the penetration(s) exceed the requirements of the

NBCC, the outlet boxes are to be protected by a firestop system. Supply and install ULC/cUL listed intumescent elastomer fire-stopping and smoke seal moldable putty pads to maintain fire-resistance rating equal to assembly. Acceptable manufacturer or approved equal:
- .1 3M Fire Barrier Moldable Putty Pads MPP+.
- .2 Hilti Firestop Putty Pad, Firestop Box Insert and CFS-P PA Firestop Putty Pad.
- .3 Specified Technologies Inc. (STI) Powershield Electrical Box Insert and Series SSP Putty Pads.

.2 Supply and install ULC/cUL listed elastomeric fire-stopping and smoke seal materials around cable, conduit and tray openings and inside of sleeve penetrations as required to maintain firestop system rating equal to assembly. Acceptable manufacturer or approved equal:
- .1 3M.
- .2 Hilti.
- .3 Specified Technologies Inc. (STI).

.3 Supply and install ULC/cUL listed fire and smoke sealing cable pass-through system at all locations where communications cable pathways penetrate fire rated assemblies. Size pass-through system assembly for required quantity of cabling plus 40% spare capacity. Fire and smoke sealing cable pass-through system to be equal in rating to assembly. Acceptable manufacturer or approved equal:
- .1 3M Fire Barrier Pass-Through Devices.
- .2 Hilti Speed Sleeve.
- .3 Specified Technologies Inc. (STI) “EZ-Path” Fire Rated Pathway.

.4 Installation of fire-stopping and smoke seal materials and components to be in accordance with ULC/cUL certification and manufacturer’s instructions.

3.3 LOCATION OF EQUIPMENT

.1 Change location of equipment at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 Prior to rough-in, coordinate locations of conduit runs with other trades.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify with Consultant before proceeding with installation.

.3 Install electrical equipment at the following heights:
- .1 Local switches: 1200 mm.
- .2 Wall receptacles:
  - .1 General: 450 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 152mm above counter or 230mm above counter with backsplash.
  - .4 In mechanical rooms: 1400 mm.
- .3 Panelboards: 1600 mm or as required by Code.
- .4 Telephone and data outlets: 450 mm.
  - .1 Above top of continuous baseboard heater: 200 mm.
  - .2 152mm above counter or 230mm above counter with backsplash.
- .5 Fire alarm manual stations: 1100 mm.
- .6 Fire alarm visual and/or audible signal devices: 2400 mm.

.7 Fire alarm end-of-line resistors: 1800 mm.
.8 Power door operator push buttons: 1100 mm.
.9 Wall mounted exit signs: 2400 mm.
.10 Emergency lighting heads: 2400 mm.
.11 Luminaires: as indicated in the Luminaire Schedule.
.12 Intrusion alarm wall mounted motion sensors: 2400 mm or as indicated on the Drawings.
.13 CCTV cameras: As indicated on the Drawings.
.14 Access control card reader stations: 1200 mm.
.15 Intrusion alarm keypad stations: 1200 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program will be permitted, under the direct supervision of a qualified licensed electrician.
.1 Permitted activities are to be determined based on the level of training attained and the demonstration of ability to perform specific duties.
.2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.
.3 Load Balance:
.1 Measure phase current to panelboard with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment. Coordinate with Utility for balancing of service transformers.
.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.
.4 Conduct and pay for following tests in accordance with Division 01 - General Requirements.
.1 Power distribution system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.
.4 Exit sign and emergency lighting.
.5 Motors, heaters and associated control equipment including sequenced operations of systems where applicable.
.6 Systems: fire alarm system, communications, CCTV, access control, intrusion alarm.
.7 Ground system continuity and resistance test.
.5 Furnish manufacturer’s certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer’s instructions.
.6 Insulation resistance testing for:
.1 Megger and record 350 – 600 V circuits, including new well pump circuits, feeders and equipment with a 1000 V instrument.
.2 Check resistance to ground before energizing and record value.
.7 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.

3.8 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
.3 Clean luminaire lenses, housings, louvers, etc. upon completion of construction.

END OF SECTION

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1 General

1.1 DESCRIPTION OF WORK

.1 Work of this Section consists of the complete removal of all obsolete or abandoned electrical equipment including, but not limited to:
  .1 Existing obsolete lighting, conduit and wire, and raceway.
  .2 Existing obsolete power and communication system conduit and wire/cabling.

.2 Alteration work including but not limited to modifications to existing lighting and lighting relay panels, branch circuits and communication systems.

.3 All removal or alteration work of electrical construction to be done in accordance with the safety standards outlined in the Canadian Electrical Code.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Division 01 - General Requirements.

1.4 SITE SURVEY

.1 Prior to Tender submission, visit the site and survey and quantify the extent of the removals and alterations required for this contract and include for all costs in the total tendered price. Any existing conditions information indicated on the drawings is for general guidance only.

.2 In conjunction with site visit, review all drawings and include all costs due to existing conditions in total tendered price.

1.5 PROTECTION

.1 The Contractor is to provide and coordinate the protection of existing structures and systems which may be damaged by work activities and is to be responsible for any damages to existing structures or systems as a result of lack of coordination and/or protection.

1.6 SALVAGE MATERIAL

.1 Existing equipment and devices designated for reuse are to be removed, stored, cleaned and re-installed as indicated on the drawings.

.2 Identify any damaged equipment or materials intended for reuse prior to demolition and point out deficiencies to the Consultant at that time.

2 Products

2.1 NOT APPLICABLE

.1 Not Applicable.

3 Execution

3.1 GENERAL REMOVALS

.1 Where indicated remove all obsolete or abandoned equipment or electrical services including wire and conduit back to the source.

.2 Coordinate work of this Section with other trades.

.3 Schedule all removal work with the Owner. Do not disrupt building operations except as permitted by the Schedule.

.4 Any existing conduit, wiring, boxes or equipment that is to remain in service is to be properly supported as required by the Canadian Electrical Code. Any additional hangers, straps or fasteners required are to be supplied under this contract.

.5 Make alterations to existing electrical -as required and make good all circuits affected by the renovations.

.6 Any existing electrical circuits and/or equipment that are interrupted during construction to accommodate alterations but are to remain in service are to be reconnected and circuits made good.

.7 Any relocating of existing equipment and any rerouting of existing wire and conduit to coordinate with new work to be included in total tendered price.

3.2 IDENTIFICATION OF EXISTING CIRCUITS AND EQUIPMENT

.1 All circuits in existing panelboards serving renovated areas are to be traced out to identify any devices not labeled on existing directories and to confirm all circuits indicated on directories are accurate. Provide new, updated, typewritten circuit directories in all panelboards modified by the renovations.

.2 Provide identification indicating circuit and panel number at all new and existing wiring devices in renovated area.

.3 Provide equipment nameplates and labels for all new and existing equipment in renovated area.

.4 Equipment identification, wiring identification and conduit and cable identification is to be in accordance with Section 26 05 00 - Common Work Results - Electrical.

3.3 CUTTING

.1 Cutting required for removals and alterations to be to the approval of the Consultant and performed with appropriate power tools.

3.4 CLEANING

.1 Reused existing equipment to be cleaned in accordance with Division 01 - General Requirements.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CAN/CSA-C22.2 No.18-98 (R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  .2 CSA C22.2 No.65-93 (R2008), Wire Connectors.
.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

2 Products

2.1 MATERIALS

.1 Crimp style wire connectors, nylon insulated, with current carrying parts of copper alloy for conductors #16 AWG and smaller.
.2 Fork tongue or ring style connectors, nylon insulated crimp style. Terminals for connecting conductors #16 AWG and smaller to screw down terminals.
.3 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required. Use twist-on connectors for #14 AWG to #8 AWG conductors.
.4 Fixture type twist-on splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors #10 AWG or less.
.5 Compression type connectors for connecting #6 AWG conductors and larger, unless indicated otherwise.
.6 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
  .1 Connector body and stud clamp for stranded round copper or aluminum conductors.
  .2 Clamp for stranded round copper or aluminum conductors.
  .3 Stud clamp bolts for copper or aluminum conductors.
  .4 Bolts for copper bar.
  .5 Sized for conductors and bars as indicated.
.7 Clamps or connectors for armoured cable, aluminum sheathed cable, Teck cable, flexible conduit, as required to: CAN/CSA-C22.2 No.18.

3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:
  .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation is to meet secureness tests in accordance with CSA C22.2 No.65.
  .2 Install fixture type connectors and tighten. Replace insulating cap.
  .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.
  .4 Where ACM conductors are used, apply zinc joint compound on aluminum conductors prior to installation of connectors or termination.
  .5 Install crimp style connectors with snap-on nylon caps on splices and joints on branch circuits.
.2 All connections are to be made electrically and mechanically secure. Size and type of connector to be in accordance with manufacturers recommendations for each wire size and combination of wires.

3.2 RESTRICTIONS

.1 Circuit splices are NOT permitted in equipment enclosures or electrical panelboards.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.
.2 Section 26 05 20 - Wire and Box Connectors (0-1000V).
.3 Section 26 05 29 - Hangers and Supports for Electrical Systems.
.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
.5 Section 26 50 00 - Lighting.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA C22.2 No. 03-09 (R2019), Test Methods for Electrical Wires and Cables.
  .2 CAN/CSA C22.2 No. 131, Type TECK 90 Cable.

2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for #8 AWG and larger, solid for #10 AWG and smaller.
.2 Minimum size to be #12 AWG for lighting and power, #14 AWG for controls, #16 AWG for low voltage and lighting relay/controls.
.3 Conductors to be sized as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE and RWU90 XLPE as indicated. Provide RWU90 XLPE rated cable for underground wiring related to well pump circuits.
.4 Single conductor metal sheathed cables are not permitted.
.5 Conductor sizes on drawings are based on copper conductors.
.6 Aluminum Composite Material (ACM) conductors will be permitted as an acceptable alternative to copper conductors for service, and panelboard feeders equal or greater than 60 A. ACM conductors are not to be terminated with copper bodied connectors, and all ACM conductor ends are to be treated with an oxide retardant coating prior to termination. The use of ACM conductors must be approved by the Consultant prior to tender submission. Exact size of ACM conductors as an alternate to copper conductors are to be verified by the Consultant prior to rough-in.

2.2 TECK CABLE

.1 Cable: to CAN/CSA C22.2 No. 131.
.2 Conductors:
  .1 Grounding conductor: copper.
  .2 Circuit conductors: copper and ACM alloy, size as indicated.
.3 Insulation:
  .1 Chemically cross-linked polyethylene (XLPE), rated RW90, 600 V.
.4 Inner jacket: polyvinyl chloride material.
.5 Armour: interlocking aluminum.
.6 Overall covering: thermoplastic polyvinyl chloride material.
.7 Fastenings:
  .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
  .2 Channel type supports for two or more cables at 1500 mm centers.
  .3 Threaded rods: 6 mm dia. to support suspended channels.
.8 Connectors:
  .1 Watertight spin-on style connectors or type approved for TECK cable.
    .1 Acceptable material:
      .1 Thomas & Betts - Star Teck.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.
.2 Type: AC90.
.3 Armour: interlocking type fabricated from aluminum strip.
.4 Connectors: standard as required, complete with double split rings in accordance with Section 26 05 20 - Wire and Box Connectors (0 - 1000 V).

2.4 ACM CONDUCTORS

.1 Annealed, compacted aluminum alloy conductor material (ACM), single or multi-conductor, 600 V insulation.
.2 Type: AC90, ACWU90 and TECK90.
.3 Armour: interlocked aluminum strip.
.4 Conductivity: 61% IACS to that of copper.
.5 Outer jacket: ACWU90 PVC jacket, FT4 rated.
.6 Restrictions: On feeders only, which are equal or greater than 60 A, and pending approval by Consultant prior to tender submission.

3 Execution

3.1 WIRING METHODS

.1 All work to be concealed in finished areas where possible, wire in painted conduit where exposed in finished areas.
.2 All work in or through fire rated structures to be in accordance with Section 26 05 00 - Common Work Results - Electrical.
.3 Panelboard feeders: building wire in conduit.
.4 Branch circuit work:
  .1 Concealed work in wall partitions: building wire in conduit or armoured cable.
  .2 Horizontal work above accessible ceilings: building wire in conduit or armoured cable.
  .3 Surface work in unfinished areas: building wire in conduit.
  .4 Armoured cable may be used where permitted by the Canadian Electrical Code for drops to new equipment in existing gypsum board walls and ceilings.
.5 Drops to light fixtures to be building wire in flexible conduit or armoured cable, maximum length 1.5 m.
.6 Branch circuit wiring to be sized for a maximum voltage drop of 3% and no greater than 5% across the entire circuit length from service to point of utilization, in accordance with CSA 22.1-24.

3.2 GENERAL CABLE INSTALLATION

.1 Support cables in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems.
.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors (0-1000 V).
.3 Cable Colour Coding: to Section 26 05 00 - Common Work Results - Electrical.
.4 Conductor length for parallel feeders to be identical.
.5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
.6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
.2 In surface and lighting fixture raceways in accordance with Section 26 50 00 - Lighting.

3.4 INSTALLATION OF TECK CABLE

.1 Install Teck cables where indicated.
  .1 Group cables wherever possible on channels.
.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors (0 - 1000 V).

3.5 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.
.2 Use permitted only for work in movable partitions and vertical power supply drops to lighting fixtures.
.3 Install anti-shorts as required.
.4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors (0 - 1000 V).

3.6 INSTALLATION OF ACM CONDUCTORS

.1 Install ACM cables as per CSA 22.1-24 and manufacturers installation requirements.
.2 Do not terminate ACM conductors with a copper bodied connector.
.3 Apply oxide coating on base cables as per CSA 22.1-24 requirements.

3.7 RESTRICTIONS

.1 Splices in wire and cable #6 AWG and larger are not permitted.
.2 Flexible conduit or armoured cable drops to luminaires are to be installed from junction box to luminaires, loops between luminaires is not permitted.
.3 Wiring and cabling, both concealed and exposed, is to be installed parallel and/or perpendicular to building lines in a clean, organized and professional fashion. Where possible, wiring and cabling is to follow a common pathway.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
.2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
.3 Perform tests before energizing electrical system.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-1989 (R1996), Qualifying Permanent Connections Used in Substation Grounding.

2 Products

2.1 EQUIPMENT

.1 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors, as required by local authority having jurisdiction.
.4 Bonding jumpers, straps.
.5 Pressure wire connectors.

3 Execution

3.1 INSTALLATION GENERAL

.1 Modify existing grounding system and install new bonding for a complete permanent, continuous grounding system including, electrodes, conductors, connectors, and accessories.
.2 Install connectors in accordance with manufacturer's instructions.
.3 Protect exposed grounding conductors from mechanical injury.
.4 Use mechanical connectors for grounding connections to equipment provided with lugs.
.5 Soldered joints not permitted.
.6 Install a bonding wire in all conduits. Where EMT is used, run insulated copper bond wire in conduit.
.7 Install internal bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.
.8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
.9 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Frames of motors, starters, control panels.

3.4 COMMUNICATION SYSTEMS

.1 Install grounding connections for modified fire alarm, intercommunication systems as follows:

.1 Communications: make grounding system in accordance with Owner's IT requirements and as indicated.

.2 Sound and fire alarm systems as indicated and in accordance with the manufacturers grounding instructions.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.
.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
.3 Perform tests before energizing electrical system.
.4 Disconnect ground fault indicator during tests.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 18.4-04 (R2019), Hardware for the support of Conduit, Tubing, and Cable (Bi-National Standard with UL 2239).

2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings as required.

2.2 SPECIFIC PURPOSE SUPPORTS

.1 Specific purpose heat treated, spring steel fasteners to support boxes, conduit and cable from main structure, channels, and metal studs.

3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with bar type box hangers. Ensure that box hangers are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.4 Strap AC90 at box location and at every 900 mm.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support two (2) or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.12 Electrical boxes concealed in hollow gypsum board walls to be supported by specific purpose brackets or clips designed for stud wall construction.

3.2 RESTRICTIONS

.1 Do not use wire lashing, wood blocking, nylon or plastic strap ('Ty-Wraps') to support or secure raceways or cables.

.2 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

.3 Do not install cable, raceway, or boxes directly to underside of roof deck, maintain a minimum separation of 38mm as required by Code.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA C22.1-24, Canadian Electrical Code, Part 1, 26th Edition.

1.3 SUBMITTALS

.1 Provide shop drawings and product data for cabinets and splitters in accordance with Division 01 - General Requirements.

2 Products

2.1 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.
.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.
.3 Covers with turned edges for surface-mounted pull and junction boxes.
.4 Splicing of access control cable harness to be completed with DIN rail mounted terminal blocks in junction boxes. Marrettes will not be accepted.

3 Execution

3.1 JUNCTION AND PULL BOXES INSTALLATION

.1 Install pull boxes in inconspicuous, but accessible locations.
.2 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
.2 Install size 2 identification labels indicating system name voltage and phase or box designation as indicated.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results – Electrical.
.2 Section 26 05 29 – Hangers and Supports for Electrical Systems.
.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware, a National Standard of Canada.
  .2 CSA 22.1-24, Canadian Electrical Code, Part 1, 26th Edition.

2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA 22.1-24.
.2 102 mm square or larger outlet boxes as required.
.3 Gang boxes where wiring devices are grouped.
.4 Blank cover plates for boxes without wiring devices.
.5 Combination boxes with steel barriers where outlets for more than one system or voltage are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
  .1 Screw-on, turned edge covers for surface mounted boxes.
.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.
.4 102 mm square or octagonal outlet boxes for luminaires.

2.3 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.
.2 Knock-out fillers to prevent entry of debris.
.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
.4 Double locknuts and insulated bushings on sheet metal boxes.
.5 Double split rings for AC90 terminations.

3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.
.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush within finished walls using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes in accordance with Section 26 05 00 - Common Work Results - Electrical.

.7 Outlet boxes and conduit boxes to be flush mounted in new construction. Outlet and conduit boxes in existing construction to be flush mounted except in existing masonry filled block walls.

.8 Install vapour barrier boxes around all galvanized steel device boxes recess mounted in exterior walls and structures.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)
- .1 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .2 CSA C22.2 No. 83-M1985 (R2017), Electrical Metallic Tubing.
- .3 CSA C22.2 No. 211.2 (R2011), Rigid PVC (Unplasticized) Conduit.
- .4 CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.
- .5 CSA C22.2 No. 18.3-12 (2022), Conduit, Tubing, and Cable Fittings (Tri-National Standard with ANCE NMX-J-017 & UL 514B).
- .6 CSA 22.1-24, Canadian Electrical Code, Part 1, 26h Edition.

1.2 SUBMITTALS

.1 Provide shop drawings and product data in accordance with Division 01 - General Requirements.

1.3 LOCATION OF CONDUITS

.1 Drawings do not show all conduits. Conduits shown on drawings are in diagrammatic form only.

2 Products

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with steel set-screw couplings and connectors.
- .1 Exposed conduit in finished areas to be painted to match adjacent finished surfaces where indicated.
- .2 As an alternative to paint, conduit with a manufacturer applied color top coat may be used.
  - .1 Acceptable material: Allied Tube and Conduit - True Color Conduit.

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, aluminum flexible metal.

.4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits spaced every 1.5 m on center.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: To CAN/CSA C22.2 No. 18.3, manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits, unless indicated otherwise.

.3 Ensure conduit bends other than factory “ells” are made with an approved bender. Making offsets and other bends by cutting and rejoining 90 degree bends is not permitted.

.4 Connectors and couplings for EMT. Steel set-screw type, size as required.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Watertight expansion fittings with integral bonding jumper suitable for 100mm linear expansion to suit installation and 19 mm deflection in all directions.
.2 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

2.6 SEALANT

.1 Low VOC mastic compound.
  .1 Acceptable material:
    .1 DS-321.
    .2 Flex Grip.
    .3 Kingco 11-600.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change or violate any part of the installed system components or the certification of the components.
.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
.3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
.4 Surface mount conduits except in finished areas or as indicated.
.5 Use rigid hot dipped galvanized steel threaded conduit for exposed work below 2.4 m above finished floor.
.6 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury, as well as concealed work in masonry construction.
.7 Use rigid PVC conduit underground and buried in or under concrete slab on grade.
.8 Use flexible metal conduit for connection to motors in dry areas, connection to recessed luminaires without a prewired outlet box, and for connection to surface or recessed luminaires work in movable metal partitions.
.9 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
.10 Use AC-90 for vertical power supply drops to luminaires.
.11 Minimum conduit size for lighting and power circuits: 21 mm. 16 mm conduit is acceptable for switch leg drops and control circuits only.
.12 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
.13 Mechanically bend steel conduit over 21 mm dia.
.14 Install fish cord in empty conduits.
.15 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
.16 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.
.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.
.5 Do not pass conduits through structural members except as indicated.
.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Not applicable.

3.6 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.
.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.7 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials rubbish, tools and equipment.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA C22.2 No.184.1, Solid-State Dimming Controls (Bi-national standard with UL 1472).

1.3 SUBMITTALS

.1 Provide shop drawings and product data in accordance with Division 01 - General Requirements.
  .1 Submit product data sheets for lighting dimming control equipment. Include product characteristics, performance criteria, physical size, limitations and finish.
.2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

2 Products

2.1 0 - 10 VDC CONTROL DIMMERS

.1 Operating voltage dimming: Control 0 - 10 VDC, 120V, 8A rated line voltage switch.
.2 ON/OFF rocker style or push button switch.
.3 Manual pre-set slide control for adjustment from maximum intensity to off, and minimum threshold adjustment to eliminate lamp flicker.
.4 Finish: White gloss.
.5 Five-year warranty.
.6 Complete with matching faceplate for single or ganged wall boxes.
.7 Suitable for installation in a one gang wall box.
  .1 Provide physical partition when ganged with one or more line voltage devices.
.8 Acceptable material:
  .1 Lutron #DVTV-WH (Single pole).

2.2 0-10 VDC CONTROL DIMMER C/W OCCUPANCY SENSING

.1 Operating voltage dimming: Control 0-10 VDC, 120V, 8A rated line voltage switch.
.2 ON/OFF rocker style or push button switch.
.3 Manual pre-set slide control for adjustment from maximum intensity to off, and minimum threshold adjustment to eliminate lamp flicker.
.4 Advanced PIR technology wall switch to provide automatic control of lighting.
.5 Programmable for either Manual-ON or Automatic-ON.
.6 Digital time delay of 15 seconds to 30 minutes.
.7 LED to indicate occupancy detection.
.8 Adjustable unit sensitivity.
.9 No minimum load requirement.
.10 Compatible with all load types.
.11 Five-year warranty.
.12 Load: up to 800 W @ 120 V.
.13 Minimum coverage: 180 deg. - 290 sq.ft.
.14 Acceptable material:
  .1 SensorSwitch #WSXA D WH BAA.
  .2 SensorWorx #SWX-101-D-WH.

3 Execution

3.1 INSTALLATION

.1 Install dimmers and remote control stations in accordance with manufacturer's instructions.
.2 Connect luminaire circuits to dimmer power sections and power packs in accordance with the manufacturers wiring instructions.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.
.2 Demonstrate that dimming systems are installed as indicated.
.3 Demonstrate that dimming systems operate as intended and that there are no problems in starting luminaires, nor in keeping them lit and flicker-free at any setting of dimming intensity control.
.4 Demonstrate that no audio, radio or TV interference is carried by system.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.
.2 Section 26 50 00 - Lighting.

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.

1.3 SYSTEM DESCRIPTION

.1 Occupancy sensors to turn lighting on when entering a controlled area and off after the area is vacated.
.2 Products sourced from a single manufacturer.

2 Products

2.1 TECHNOLOGY

.1 Passive infrared (PIR) sensing systems are passive and react only to energy sources. They detect the difference between heat emitted by the human body and the background space.
.2 Dual technology (DT) sensors use both PIR and US technologies.

2.2 PASSIVE INFRARED AUTOMATIC WALL SWITCH

.1 Advanced PIR technology wall switch to provide automatic control of lighting.
.2 Programmable for either Manual-ON or Automatic-ON.
.3 Digital time delay of 15 seconds to 30 minutes.
.4 LED to indicate occupancy detection.
.5 Adjustable unit sensitivity.
.6 No minimum load requirement.
.7 Compatible with all load types.
.8 Five-year warranty.
.9 Load: up to 800 W @ 120 V.
.10 Minimum coverage: 180 deg. - 290 sq.ft.
.11 Finish: White.
.12 Acceptable material:
    .1 Lutron #4-MS-OPS6M2-DV
    .2 Cooper Greengate #OSW-P-0801-120-W.
    .3 Wattstopper #PW-100.
    .4 Steinel #IR-WLS-1W

2.3 DUAL TECHNOLOGY CEILING SENSOR

.1 40 kHz frequency ultrasonic transmission.
.2 Digital time delay of 15 seconds to 30 minutes (fixed), walk-through or test-mode.
.3 Sensitivity adjustment.
.4 2000 sq.ft. of walking motion mounted at 10'.
.5 Dimensions: 4.5" diameter, 1" deep.
.6 Five year warranty.
.7 Acceptable material:
    .1 Lutron #LOS-CDT-2000.
    .2 Cooper Greengate #OAC-DT-1000.
    .3 WattStopper #DT-305.
    .4 Steinel.

3 Execution

3.1 INSTALLATION

.1 Obtain complete installation instructions from manufacturer prior to rough-in.
.2 Review sensor locations on site prior to rough-in and install in location within room that provides maximum sensor coverage but confines coverage to the room. Motion outside the room is not to activate lighting within the room.
.3 Locate occupancy sensors on vibration-free surfaces at least 1.8 m away from air vents.
.4 Wire sensors into circuits as indicated to control luminaires in the indicated areas of coverage.
.5 Program sensors and timers with time delay off set to 15 minutes.
.6 Occupancy sensors are to be individually adjusted in accordance with the manufacturer's recommendations for the specific room in which they are installed, taking into account room shape, size and usage.
.7 Test for acceptable operation.
.8 Demonstrate operation to the satisfaction of the Consultant.

3.2 COMMISSIONING

.1 The system must be completely commissioned prior to interim inspection to verify optimum operation.
.2 Sensors must be added or relocated and patterns adjusted as required to eliminate nuisance turning on/off of luminaires.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.
.2 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity, interrupting capacity, incoming feeder location, and enclosure dimensions.

2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
  .1 Install circuit breakers in panelboards before shipment.
  .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
.2 250 V panelboards: bus and breakers rated for 10,000 A (symmetrical) minimum interrupting capacity respectively or as indicated on electrical drawings.
  .1 Where new circuit breakers are installed in existing panelboards, the minimum interrupting capacity of the new circuit breakers is to match the minimum interrupting capacity of the existing panelboard and associated circuit breakers.
.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
.5 Two keys for each panelboard and key panelboards alike.
.6 Tin plated aluminum bus with neutral of same ampere rating as mains. Panelboards are to be supplied fully bussed.
.7 Mains: suitable for bolt-on breakers.
.8 Trim and door finish: baked grey enamel with concealed front bolts and hinges.
.9 Minimum tub width of 500 mm.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
.4 Lock-on devices as indicated. Turn over unused lock-on devices to Owner's Representative.
.5 Lock-on devices are to be installed and branch circuit breakers are to be painted red for fire alarm, clock outlet, emergency, door supervisory, intercom, stairway, exit light and night light circuits as indicated.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
.2 Nameplate for each panelboard size 4 engraved as indicated.
.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4 MANUFACTURERS

.1 Acceptable material:
  .1 Schneider.
  .2 Siemens.
  .3 Cutler-Hammer.

3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
.2 Mount panelboards to height specified in Section 26 05 00 – Common Work Results - Electrical or as indicated.
.3 Connect loads to circuits.
.4 Connect neutral conductors to common neutral bus with respective neutral identified.
.5 Balance phase loading and complete testing in accordance with Section 26 05 00 - Common Work Results - Electrical.

END OF SECTION

1 General

1.1 LIST OF ELECTRICAL PANEL SCHEDULES

.1 Panel '101'
.2 Panel '102"
.3 Panel '104'
.4 Panel 'D101'

PANEL '101'

VOLTS: 120/208V
PHASES: 3
WIRES: 4
MAINS: 250

LOCATION: EXISTING ELECTRICAL ROOM
NUMBER OF CIRCUITS: 42
MOUNTING: SURFACE
SOURCE: D101

LGD	DESIGNATION	BKR	P	CCT	A	B	C	A	B	C	CCT	P	BKR	DESIGNATION	LGD
	EXISTING LOAD	15	1	1	0			0			2	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	3		0			0		4	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	5			0			0	6	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	7	0			0			8	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	9		0			0		10	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	11			0			0	12	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	13	0			0			14	1	15	EXISTING LOAD	
	SPARE	15	1	15		0			0		16	1	15	EXISTING LOAD	
	SPARE	15	1	17			0			0	18	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	19	0			0			20	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	21		0			750		22	2	15	BB-1	
	SPARE	15	1	23			0			750	24				
	LIGHTING: RMS 310, 311, 312, 313, & 330	15	1	25	600			0			26	1	15	SPARE	
	RECEPT: TOOLS 310 & RECEIVING 311	20	1	27		600			0		28	1	15	SPARE	
	RECEPT: WAREHOUSE AREA	20	1	29			600			0	30	1	15	SPARE	
	RECEPT: STORAGE 312	20	1	31	360			0			32	1	15	SPARE	
	SPACE			33		0			480		34	1	20	RECEPT: GREENBUILD LAB	
	EXISTING LOAD	20	1	35			0			360	36	1	20	RECEPT: GREENBUILD LAB	
	EXISTING LOAD	15	1	37	0			480			38	1	20	RECEPT: GREENBUILD LAB	
	EXISTING LOAD	15	1	39		0			0		40	1	20	EXISTING LOAD	(*)
	EXISTING LOAD	30	1	41			0			0	42			SPACE	

	PHASE A	PHASE B	PHASE C
TOTAL PHASE LOADS:	1440	1830	1710
TOTAL LOADS:	4980		
TOTAL AMPERAGE:	14		

LEGEND (LGD)

LOCKING BREAKER	(*)
ARC FAULT BREAKER	(A)
SWITCHING BREAKER	(SW)
GFCI BREAKER	(GFI)

PANEL '102'

VOLTS: 120/208V
PHASES: 3
WIRES: 4
MAINS: 250

LOCATION: STORAGE 330
NUMBER OF CIRCUITS: 42
MOUNTING: SURFACE
SOURCE: D101

LGD	DESIGNATION	BKR	P	CCT	A	B	C	A	B	C	CCT	P	BKR	DESIGNATION	LGD
	EXISTING LOAD	15	1	1	0			0			2	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	3		0			0		4	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	5			0			0	6	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	7	0			0			8	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	9		0			0		10	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	11			0			0	12	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	13	0			0			14	1	15	EXISTING LOAD	
	EXISTING LOAD	15	1	15		0			0		16	1	15	EXISTING LOAD	
	EXISTING LOAD	30	3	17			0			120	18	1	15	DOOR POWER SUPPLY	
				19	0			120			20	1	15	ACCESS CONTROL PANEL	
				21		0			497		22	2	15	P-3	
	DOOR POWER SUPPLY	15	1	23			120			497	24				
	DOOR POWER SUPPLY	15	1	25	120			0			26	1	15	SPARE	
	DOOR POWER SUPPLY	15	1	27		120			0		28	3	15	SPARE	
	ACCESS CONTROL PANEL	15	1	29			120			0	30				
	P-1	15	3	31	497			0			32				
				33		497			3250		34	3	60	HP-8	
				35			497			3250	36				
	P-2	15	3	37	497			3250			38				
				39		497			120		40	1	15	GF-1	
				41			407			0	42			SPACE	

	PHASE A	PHASE B	PHASE C
TOTAL PHASE LOADS:	4484	4981	5011
TOTAL LOADS:	14476		
TOTAL AMPERAGE:	40		

LEGEND (LGD)

LOCKING BREAKER	(*)
ARC FAULT BREAKER	(A)
SWITCHING BREAKER	(SW)
GFCI BREAKER	(GFI)

PANEL '104'

VOLTS: 120/208V
PHASES: 3
WIRES: 4
MAINS: 250

LOCATION: STORAGE 330
NUMBER OF CIRCUITS: 42
MOUNTING: SURFACE
SOURCE: D101

LGD	DESIGNATION	BKR	P	CCT	A	B	C	A	B	C	CCT	P	BKR	DESIGNATION	LGD
	RECEPT: CLASSROOM 301	15	1	1	600			623			2	1	15	LIGHTING: RMS 300 - 306	
	RECEPT: CLASSROOM 301	15	1	3		600			120		4	1	15	DOOR POWER SUPPLY	(*)
	RECEPT: FUTURE DEVELOPENT 314-329	20	1	5			480			1375	6	1	15	LIGHTING: GREENBUILD LAB	
	RECEPT: COMMON AREA 300 & GREENBUILD LAB 308	20	1	7	600			1227			8	2	15	HP-1	
	RECEPT: WATER BOTTLE FILL STATION	15	1	9		120			1227		10				
	RECEPT: OFFICE 302	15	1	11			480			1227	12	2	15	HP-2	
	RECEPT: OFFICE 303	15	1	13	480			1227			14				
	RECEPT: CLASSROOM 306	15	1	15		600			822		16	2	15	HP-3	
	RECEPT: CLASSROOM 306	15	1	17			600			822	18				
(*)	DOOR POWER SUPPLY	15	1	19	120			120			20	1	15	MECHANICAL CONTROLS	
(*)	ACCESS CONTROL PANEL	15	1	21		120			1000		22	1	15	EXISTING WATER HEATER	
(*)	LIGHTING: GREENBUILD LAB	15	1	23			981			500	24	1	15	LIGHTS AND RECEPT EXISTING BATHROOM	
	DOOR POWER SUPPLY	15	1	25	120			2250			26	2	30	WH-3	
	SPARE	15	1	27		0			2250		28				
	SPARE	15	1	29			0			0	30	1	15	SPARE	
	SPARE	15	1	31	0			0			32			SPACE	
	SPARE	15	1	33		0			0		34			SPACE	
	SPARE	15	1	35			0			0	36			SPACE	
	SPACE			37	0			0			38			SPACE	
	SPACE			39		0			0		40			SPACE	
	SPACE			41			0			0	42			SPACE	

	PHASE A	PHASE B	PHASE C
TOTAL PHASE LOADS:	7367	6859	6465
TOTAL LOADS:	20691		
TOTAL AMPERAGE:	58		

LEGEND (LGD)

LOCKING BREAKER	(*)
ARC FAULT BREAKER	(A)
SWITCHING BREAKER	(SW)
GFCI BREAKER	(GFI)

PANEL 'D101'

VOLTS: 120/208V
PHASES: 3
WIRES: 4
MAINS: 600A RATED

LOCATION: EXISTING ELECTRICAL ROOM
NUMBER OF CIRCUITS: 48
MOUNTING: SURFACE
SOURCE: SWITCHBOARD

LGD	DESIGNATION	BKR	P	CCT	A	B	C	A	B	C	CCT	P	BKR	DESIGNATION	LGD
	PANEL 104	80	3	1	0			0			2	3	125	PANEL 102	
				3		0			0		4				
				5			0			0	6				
	PANEL 105	100	3	7	0			0			8	3	100	PANEL 101	
				9		0			0		10				
				11			0			0	12				
	EXISTING PANELBOARD	100	3	13	0			0			14	3	60	STORAGE PANEL	
				15		0			0		16				
				17			0			0	18				
	MOTOR LAB	200	3	19	15000			2882			20	3	30	FUTURE MOCK HOUSE	
				21		15000			2882		22				
				23			15000			2882	24				
	WP-1	40	3	25	2225			2510			26	3	30	HP-5	
				27		2225			2510		28				
				29			2225			2510	30				
	WP-2	40	3	31	2225			2510			32	3	30	HP-6	
				33		2225			2510		34				
				35			2225			2510	36				
	HP-4	45	3	37	4059			1537			38	3	30	HP-7	
				39		4059			1537		40				
				41			4059			1537	42				
	SPACE			43	0			0			44			SPACE	
	SPACE			45		0			0		46			SPACE	
	SPACE			47			0			0	48			SPACE	

	PHASE A	PHASE B	PHASE C
TOTAL PHASE LOADS:	32948	32948	32948
TOTAL LOADS:	98844		
TOTAL AMPERAGE:	275		

LEGEND (LGD)

LOCKING BREAKER	(*)
ARC FAULT BREAKER	(A)
SWITCHING BREAKER	(SW)
GFCI BREAKER	(GFI)

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
- .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
- .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
- .3 CSA-C22.2 No.55, Special Use Switches.
- .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.

2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, double pole, three-way, four-way switches as indicated to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose AC switches with following features:
- .1 Terminal holes approved for # 10 AWG conductor.
- .2 Silver alloy contacts.
- .3 Suitable for side wiring.
- .4 White toggle.
- .5 Commercial specification grade.

.3 Toggle operated fully rated for LED drivers/lamps and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable material:
- .1 Hubbel HBL 1201 W,
- .2 Leviton 1201-2W,
- .3 Pass and Seymour.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type as indicated, U ground, to: CSA-C22.2 No.42 with following features:
- .1 White thermoplastic moulded housing.
- .2 Suitable for # 10 AWG conductor for side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.
- .6 Commercial specification grade.
- .7 Acceptable material:
  - .1 Standard Duplex, CSA type 5-15 R:
    - .1 Cooper #CR15W.
    - .2 Hubbell #CR15WHI.
    - .3 Leviton #CR15-WH.
    - .4 Pass & Seymour #PS5262W.

.2 Decora Duplex, CSA 5-20R:
.1 Cooper #6352W.
.2 Hubbell #DR20-WHI.
.3 Leviton #DR20-WH.
.4 Pass & Seymour #26352W.

.2 Duplex ground fault circuit interrupter (GFCI) receptacles to have the following features:
.1 White thermoplastic housing.
.2 Suitable for side wiring.
.3 0.025s trip-time and 10,000 A maximum interrupting capacity.
.4 Integral test button and indicator light.
.5 Acceptable material:
.1 Decora Duplex CSA 5-15R:
.1 Cooper #VGF15-W.
.2 Hubbell #GF15WLA.
.3 Leviton #N7599-WH.
.4 Pass & Seymour #1595W.

.3 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
.2 Cover plates from one manufacturer throughout project.
.3 Nylon ivory or stainless steel cover plates as indicated, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.
.4 Sheet metal cover plates with turned-in corners for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
.5 All wiring device cover plates to be labeled using clear, self adhesive vinyl strips with black type lettering identifying panel and circuit number for each device. White vinyl strips will not be permitted.

3 Execution

3.1 INSTALLATION

.1 Switches:
.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Receptacles:
.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
.2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical.
.3 Do not use back entrances for connecting wiring devices to circuits. Wrap conductors around screw terminals and tighten. Tighten all unused screw terminals.

.3 Cover plates:
.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
.2 Install suitable common cover plates where wiring devices are grouped.
.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
.4 Do not install outlet boxes back-to-back in wall; allow 150 mm horizontal clearance between boxes.

3.2 TESTING

.1 All receptacles to be tested for voltage drop and results recorded where branch circuit voltage drop exceeds 3% from branch circuit panelboard to the point of utilization, in accordance with the Canadian Electrical Code, branch circuit wiring will have to be modified to meet the 3% requirement unless otherwise approved by the Authority Having Jurisdiction.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE)
  .1 ANSI/IEEE C37.13, Low Voltage AC Power Circuit Breakers Used in Enclosures.
.2 Canadian Standards Association (CSA)
  .1 CSA C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .1 Include time-current phase protection co-ordination characteristic curves for breakers with ampacity 100 A and over or breakers with interrupting capacity of 22,000 A (symmetrical) and over at system voltage.

2 Products

2.1 MOULDED BREAKERS GENERAL

.1 Moulded-case circuit breakers, to CSA C22.2 No. 5.
.2 Bolt-on moulded-case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C ambient.
.3 Common-trip breakers: with single handle for multi-pole applications.
.4 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection. Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
.5 Circuit breakers with interchangeable trips on units over 225 A as indicated.
.6 Breakers are to be by the same manufacturer as the panelboard in which they are being installed.
.7 Circuit breakers to match panelboard interrupting capacity with minimum 10 kA at 208 V.
.8 Breakers must be new, complete with original factory warranty and supplied from an authorized manufacturer's distributor.

3 Execution

3.1 INSTALLATION

.1 Connect load terminals of breaker to feeders.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance Section 26 05 00 – Common Work Results - Electrical
.2 Check factory made connections for mechanical security and electrical continuity.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CAN/CSA C22.2 No. 4-89 (R2000), Enclosed Switches.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.

2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible, horsepower rated disconnect switch in CSA Enclosure type 1, to CAN/CSA C22.2 No. 4, size as indicated.
.2 Provision for padlocking in on-off switch position by three locks.
.3 Mechanically interlocked door to prevent opening when handle in ON position.
.4 Quick-make, quick-break action.
.5 ON-OFF switch position indication on switch enclosure cover.

2.2 MANUFACTURERS

.1 Acceptable material:
  .1 Schneider.
  .2 Siemens.
  .3 Cutler-Hammer.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
.2 Indicate name of load controlled on size 4 nameplate.

3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses as indicated.
.2 Ensure proper working operation, protection of components and work space clearances around disconnect switch.
.3 In finished areas mount disconnect switches on top of flush mounted junction box with conduit nipple on its coverplate into the back of the switch.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

.1 International Electrotechnical Commission (IEC)
  .1 IEC 60947-4:2023, Part 4: Contactors and motor-starters.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
.2 Product data to indicate:
  .1 Mounting method and dimensions.
  .2 Starter size and type.
  .3 Layout of identified internal and front panel components.
  .4 Enclosure types.
  .5 Wiring diagram for each type of starter.
  .6 Interconnection diagrams.

2 Products

2.1 MATERIALS

.1 Starters: to IEC 60947 with AC4 utilization category.

2.2 MANUAL MOTOR SWITCHES

.1 Manual switch, 1, 2 or 3 poles as required. Mounted in CSA 1 Enclosure with quick-make, quick-break toggle switch.
.2 Rated for 30 A at 250 V AC, 20 A at 600 V AC.
.3 Shielded toggle with provision to be padlocked in ON or OFF positions.
.4 Acceptable material:
  .1 Cutler-Hammer #B230AG/B330AG.
  .2 Square D Class #2510, Type K.
  .3 Hubbell No. #7832/7810-UD.
  .4 Siemens Class 12.

2.3 MANUAL MOTOR STARTERS

.1 Single, three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
  .1 Switching mechanism, quick make and break.
  .2 One/three overload heaters, manual reset, trip indicating handle.
.2 Accessories:
  .1 Toggle heavy duty labelled as indicated.
  .2 Indicating light: standard heavy duty type and colour as indicated.
  .3 Locking tab to permit padlocking in "ON" or "OFF" position.
.3 Acceptable material:
  .1 Cutler-Hammer Type MS.
  .2 Siemens Type SMF.
  .3 Square D Class #2510, Type F.
  .4 Allen Bradley Bulletin #600.

2.4 FULL VOLTAGE MAGNETIC STARTERS

.1 Not applicable.

2.5 CONTROL TRANSFORMER

.1 Not applicable.

2.6 ENCLOSURE

.1 Enclosure: CSA type 1 unless indicated otherwise.

2.7 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
.2 Manual starter and switch designation label, white plate, black letters, size 1, engraved as indicated.
.3 Magnetic starter designation label, white plate, black letters, size 1 engraved as indicated.

3 Execution

3.1 INSTALLATION

.1 Prior to installation verify motor sizes with division supplying motor to ensure starter and overload relay match equipment being supplied.
.2 Install starters, connect power and control as indicated.
.3 Ensure correct fuses and overload devices elements installed. Adjust overload relay settings or install new thermal overload onsite to match motor nameplate.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.
.2 Operate switches, contactors to verify correct functioning.
.3 Perform starting and stopping sequences of contactors and relays.
.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE).
  .1 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.
.2 Illuminating Engineering Society of North America (IESNA).
  .1 LM-79, Photometric Measurements of Solid State Lighting Products.
  .2 LM-80, Measuring Lumen Maintenance of LED Light Sources.
  .3 TM-21, Projecting Long Term Lumen Maintenance of LED Light Sources.
.3 United States of America, Federal Communications Commission (FCC).
  .1 FCC (CFR47) EM and RF Interference Suppression.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.3 SUBMITTALS

.1 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Owner’s Representative.
.2 Photometric data to include: VCP Table and spacing criterion and luminaire coefficient of utilization (CU) tables and/or electronic IES files.
.3 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.4 Quality assurance submittals: provide the following in accordance with Division 01 - General Requirements.
  .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation, wiring, operation and cleaning procedures.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Division 01 - General Requirements.
.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

1.5 ACCEPTABLE MATERIAL

.1 Luminaires described in the Luminaire Schedule identify the minimum standard of quality and performance criteria which is acceptable for product. Named fixtures are acceptable with modifications and accessories as indicated.
.2 Fixtures from other manufacturers may be acceptable provided:
  .1 Appearance and lighting performance are similar.
  .2 Quality is equal or better.
  .3 Luminaire performance is equal or better.
  .4 The fixture is provided with modifications and accessories to provide a complete product in keeping with the intent of the project.
  .5 Approval in writing is obtained from the Consultant to the Contractor five (5) days prior to tender closing date.

2 Products

2.1 LED DRIVERS

.1 Power supply units including drivers:
  .1 Minimum efficiency of 85%.
  .2 Operate between -40°C and +50°C.

.3 120 V (±10%) input voltage; UL Class 1 or 2 output.
.4 Dimmable where indicated in Luminaire Schedule
.5 Power factor greater than or equal to 0.90; total harmonic distortion less than or equal to 20%.
.6 Located with luminaire housing or remote as indicated.
.7 Minimum five (5) year warranty.

2.2 LED LUMINAIRES

.1 Proposed equal fixtures not listed in the Luminaire Schedule must meet or exceed the overall performance requirements of the specific space without requiring changes to designed branch circuiting due to higher power consumption.
.2 Luminaire efficacy to be a minimum of 90 lumens/watt, unless noted otherwise in the Luminaire Schedule.
.3 Color rendering index to be a minimum 80 for all lighting.
.4 Color temperature as indicated in the Luminaire Schedule.
.5 Luminaire shall be tested using IESNA LM-79-08, in situ temperature measurement test (ISTMT) and IESNA LM-80-08 in an EPA recognized laboratory.
.6 A minimum flux maintenance life to L80 as calculated using IESNA TM-21-21 standard.
.7 Luminaire distribution to be as indicated on the Luminaire Schedule.
.8 Minimum five (5) year warranty on complete LED system including LED modules and driver.

2.3 FINISHES

.1 Light fixture finish as indicated in Luminaire Schedule. Finish to meet ULC listings and CSA certifications related to intended installation.

2.4 LUMINAIRES

.1 As indicated in Luminaire Schedule on drawings. Provide 10% spare lamps of each type noted in Luminaire Schedule. [DESIGN NOTE: OPTIONAL] Provide # spare Type # luminaires.

3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated on the drawings and in accordance with manufacturers installation instructions.
.1 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits.
.1 Install flexible conduit for vertical power supply drop to luminaires as indicated. Horizontal wiring using flexible conduit is not permitted.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires from ceiling grid in accordance with local inspection requirements.
.2 Provide additional supports connected directly to building structure as required by manufacturer. Coordinate installation of additional support infrastructure with General Contractor prior to installation of suspended ceiling grid.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical

3.6 CLEANING

.1 Luminaire lenses, housings, louvers, etc., are to be cleaned upon completion of construction in accordance with Division 01 - General Requirements.

END OF SECTION

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1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results – Electrical.
.2 Section 26 05 21 - Wires and Cables (0-1000 V).
.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements. Product data to indicate system components, mounting method, source of power and special attachments.

1.5 WARRANTY

.1 For batteries, the ten years warranty period is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years from the date of Substantial Completion.

2 Products

2.1 EMERGENCY LIGHTING

.1 Emergency lighting equipment: to CSA C22.2 No.141.
.2 Supply voltage: 120 V, AC.
.3 Output voltage: 12 V DC.
.4 Operating time: 30 minutes to NBCC 2020.
.5 Battery: sealed, maintenance free.
.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
.7 Solid state transfer circuit.
.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
.9 Signal lights: solid state, for 'AC Power ON'.
.10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: 5W MR16 LED.
.11 Cabinet: suitable for direct mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
.12 Finish: standard.
.13 Auxiliary equipment:
  .1 Test switch.
  .2 Time delay relay.
  .3 Battery disconnect device.
  .4 AC input and DC output terminal blocks inside cabinet.
  .5 RFI suppressors.

2.2 MANUFACTURER

.1 Acceptable material:

.1 Aimlite #EBST122MDWHTAT.
.2 Ready-Lite #LDX12-36-AD-2-LD10.
.3 Lumacell #RG12S362LD10AT.
.4 Stanpro #SLA-1236-2S4WLR-WHAT.

2.3 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
.2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V) sized as indicated in accordance with manufacturer's recommendations.

3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.
.2 Direct heads.
.3 Connect exit lights to unit equipment.
.4 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.
  .2 CSA C860, Performance of Internally-Lighted Exit Signs.
.2 National Fire Protection Association (NFPA)
  .1 NFPA 101, Life Safety Code.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements:
  .1 Product data to include performance criteria, physical size, finish and limitations.
.2 Manufacturer’s Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures and disposal.

2 Products

2.1 EXIT SIGNS

.1 Exit signs: to CSA C22.2 No.141 and CSA C860.
.2 120 VAC normal power.
.3 Housing: Aluminum c/w white powder coat finish.
.4 Face: Edge lit acrylic with pictorial white running man on green face with chevrons as indicated on drawings.
.5 Lamps: multiple - LED - 120 V input, 4 W.
.6 10 years unconditional Parts and Labour Warranty.
.7 Double or single face, universal wall or ceiling mounted as indicated on the drawings.
.8 Acceptable material:
  .1 Lumacell #LA Series.
  .2 Ready-Lite #RA Series.
  .3 Aim-Lite #RPALW Series.
  .4 Stanpro #RMXL Series.

3 Execution

3.1 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, code and local regulatory requirements.
.2 Connect fixtures to exit light circuits using RW90 wire in EMT conduit.
.3 Connect emergency lamp sockets to emergency circuits.
.4 Ensure that exit light circuit breaker is locked in on position.
.5 Provide tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

3.2 CLEANING

.1 Clean Exit signs upon completion of construction in accordance with Division 01 - General Requirements.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results – Electrical.
.2 Section 26 05 28 – Grounding – Secondary.

1.2 REFERENCES

.1 American National Standards Institute.
  .1 ANSI J-STD-607-D, Joint Standard - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
.2 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA).
  .1 TIA/EIA-606-C, Administration Standard for the Commercial Telecommunications Infrastructure.

1.3 SYSTEM DESCRIPTION

.1 Telecommunications grounding and bonding system consists of, but not limited to grounding busbars, bonding backbones, and other bonding conductors.
.2 Provides ground reference for telecommunications systems within building and bonding to it of telecommunications rooms.
.3 Metallic pathways, cable shields, conductors, and hardware within telecommunications spaces are bonded to telecommunications grounding and bonding system.

2 Products

2.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

.1 Predrilled copper busbar, listed by NRTL, electrotin plated with holes 1/3" diameter for use with standard-sized lugs to: ANSI J-STD-607-A.
.2 Dimensions 1/4" thick, 4" wide, 12" long on insulated supports to: ANSI J STD-607-D.
.3 Acceptable material:
  .1 Erico #TMGB-A14L15PT

2.2 BONDING CONDUCTOR FOR TELECOMMUNICATIONS (BCT)

.1 Copper stranded conductor, green insulated marked to: ANSI J-STD-607-A.

2.3 WARNING LABELS

.1 Non-metallic warning labels adjacent to all backbone and bonding conductor terminations in English to: ANSI J-STD-607-D.
.2 Identify labels with wording "If this connector is loose or must be removed, please call the building telecommunications manager".

3 Execution

3.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

.1 Install TMGB in telecommunications entrance room at location indicated.
.2 Install #1/0 AWG copper bonding conductor in 21mmC from TMGB to alternating current equipment ground at service entrance.
.3 Use 2 hole compression lugs for grounding connections.

3.2 BONDING CONDUCTORS GENERAL

.1 Ensure all data/ telephone system conduits are properly grounded. For conduit drops at workstation locations and for sleeves, install ground bushings and a #14 AWG green

insulated bonding conductor to closest grounded raceway or junction box. Use #6 AWG green insulated bonding conductor for connections in Telecommunications Room.

3.3 BONDING FOR TELECOMMUNICATIONS

.1 Bond metallic raceways in telecommunications rooms to TMGB using #6 AWG green insulated copper conductor.

.2 For cables within telecommunications rooms having shield or metallic member, bond shield or metallic member to TMGB using #6 AWG green insulated copper conductor.

.3 Bond equipment rack and cabinets located in telecommunications rooms to TMGB using #6 AWG green insulated copper conductor.

3.4 LABELLING

.1 Apply warning labels to telecommunications bonding and grounding conductors.

.2 Apply additional administrative labels to: TIA/EIA-606.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.
.2 Section 26 05 31 - Splitters, Junction and Pull Boxes.
.3 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
.4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
.5 Section 26 05 36 - Cable Trays for Electrical Systems.
.6 Section 27 05 26 - Grounding and Bonding for Communications Systems.

1.2 REFERENCES

.1 American National Standards Institute:
  .1 ANSI/TIA-569-E, Telecommunications Pathways and Spaces.
  .2 ANSI/TIA-606C, Administration Standard for Commercial Telecommunications Infrastructure.
.2 Holland College Structured Cabling Standards Dated March 2020.

1.3 SYSTEM DESCRIPTION

.1 Telecommunications pathway system consists of, but not limited to outlet boxes, conduits, pull boxes, fish wires, J-hooks and wire basket tray.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.

2 Products

2.1 MATERIAL

.1 Conduits: type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
.2 Outlet boxes: 4" sq. with single device cover and fittings: in accordance with Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings.
.3 J-hook support clips: Caddy “CableCat Clip”.
  .1 Acceptable material:
    .1 Caddy "Cable CAT Clip".
    .2 Cooper B-Line.
.4 Velcro cable ties:
  .1 Acceptable material:
    .1 Panduit #HLS-15RO.

3 Execution

3.1 INSTALLATION

.1 Install raceway system, including outlet boxes, conduit, miscellaneous and positioning material to constitute complete system.
.2 Install conduit from data/telephone outlet box locations to accessible corridor ceiling space. Use 27mm EMT. Use 100mm x 100mm x 50mm device boxes with single gang plaster rings at outlet box locations.
  .1 Where communications cables are run above inaccessible ceiling spaces, use appropriately sized zone conduit between accessible locations and group cables neatly together when routed to outlets. Indicate routing on as-built drawings.

.3 Ensure all data/ telephone system conduits are properly grounded. Where required, install ground bushings and a #14 AWG bare bonding conductor to closest grounded raceway or junction box, or #6 AWG, where indicated.

.4 Communications conduits in telecommunications rooms are to be bonded to ground in accordance with Section 27 05 26 - Grounding and Bonding for Communications Systems.

.5 Dress cabling using Velcro cable ties. The use of nylon or plastic ties is not permitted.

.6 Cable management in accessible ceiling spaces.

.1 J-hook supports as required to support loose cable bundles at 1000 mm maximum spacing to point of entry into conduit system.

.2 Provide support for individual cables using velcro ties at 1000 mm maximum spacing to point of entry into conduit system.

.7 All zone conduit are to be identified and labelled at both ends and at pull boxes to TIA-606 and TIA-569. Tags are to identify start and finish of conduit runs.

.8 Pullboxes for communications cabling are to be installed at a reasonable height in an exposed location, such that access for installation of cables is not prohibited. Pullboxes are to not be installed above gypsum or inaccessible ceiling types unless immediately above a suitably sized access hatch. Provide indicator vinyl decals on ceiling T-bar rail identifying location of pullbox above.

.9 Cable fill capacities of conduit, cable tray and raceways is to be maximum 40%.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results – Electrical.
.2 Section 27 05 26 – Grounding and Bonding for Communications Systems.
.3 Section 27 05 28 – Pathways for Communications Systems.

1.2 REFERENCES

.1 Canadian Standards Association
  .1 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).
.2 Telecommunications Industry Association (TIA)
  .1 ANSI/TIA-568.0-E Generic Telecommunications Cabling for Customer Premises.
  .2 ANSI/TIA-568.1-E Commercial Building Telecommunications Cabling Standard.
  .3 ANSI/TIA-568.2-D Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
  .4 ANSI/TIA-568.3-D Optical Fiber Cabling and Components Standard.
  .5 ANSI/TIA-569-E, Telecommunications Pathways and Spaces.
  .6 ANSI/TIA-526-7-A, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
  .7 ANSI/TIA-526-14-C, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
  .8 ANSI/TIA-606-C, Administration Standard for Commercial Telecommunications Infrastructure.
  .9 ANSI/TIA-607-D, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
  .10 ANSI/TIA-1152-A, Requirements for Field Test Instruments and Measurements for Balanced Twisted Pair Cabling.
  .11 Government of Canada Workplace Fit-up - Special Technical Standards Guidelines (Section A4), Telecommunications (Cable Networks) Pathways and Spaces - Planning and Implementation.
.3 BICSI - Building Industry Consulting Service International:
  .1 Telecommunications Distribution Methods Manual 13th Edition.
  .2 ANSI/NECA/BICSI-568-2006, Standard for Installing Commercial Building Telecommunications Cabling.
.4 Holland College Structured Cabling Standards Dated March 2020.

1.3 SYSTEM DESCRIPTION

.1 Structured telecommunications wiring system consist of unshielded-twisted-pair cables, terminations, connectors, cross-connection hardware, racks, and related equipment installed inside building for occupant's telecommunications systems. Services for the fire alarm system to be connected directly to the telephone service entrance.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
.2 The Contractor shall generate shop drawings for approval prior to commencement of work. Shop drawings shall include cable routes, conduit penetration locations, elevation drawings of equipment racks, patch panels, termination blocks, connection details, rack mounting details and other relevant details not included in the construction drawings.
.3 As-built Records and Drawings:
  .1 Provide and place one hard copy of as-built records in telecommunications room.

1.5 QUALITY ASSURANCE

.1 All cabling, termination hardware and connecting cords to be sourced from a certifying manufacturer to assure quality control.

.2 The system is to have an end-to-end 20-year warranty against defects in materials and labour. Certified system vendor to repair or replace any failed component, including labour at no cost to the Owner. Provide system test results, certificates and warranty in Maintenance Manuals.

.3 Contractor shall be a licensed to install telecommunications systems in the locale where work will be performed.

1.6 DELIVERY, STORAGE AND PROTECTION

.1 Materials and equipment furnished shall be delivered in new condition and be of current production lots.

.2 Contractor shall ensure that material deliveries to work site shall be coordinated with construction manager responsible for materials distribution to all trades. Handle in accordance with Manufacturer's recommendations and instructions to avoid damaging equipment, installed devices and finish.

.3 Contractor shall coordinate for the removal of all rubbish and packing materials produced by the Contractor's activities during the project.

.4 Contractor shall ensure materials are stored according to Manufacturer's recommendations. In addition, materials must be stored in a location protected from vandalism and weather.

2 Products

2.1 TELEPHONE BACKBONE CABLES

.1 25 pair, 24 AWG solid bare copper conductors, polylefin colour coded insulation, Category 5e riser cable, CMP FT4 PVC white jacket.

.1 Acceptable material:

.1 Belden #IBDN25R.

.2 Superior Essex # 51-478-48

2.2 HORIZONTAL DATA/TELEPHONE CABLES

.1 100 OHM, 4 pair, 24 AWG U/UTP Balanced Twisted Pair Cable - CMP/FT6.

.1 Cable shall comply with ANSI/TIA-568.2-D, ISO/IEC 11801, EN50173 Category 6, IEC 61156-5 standards and be RoHS Compliant.

.2 Cable shall be 4pr 24 awg U/UTP construction and available in CMP/FT6 fire rating.

.3 Plenum (CMP/FT6) cables shall be cULus listed to UL 444 - CAN/CSA C22.2 No. 214.

.4 Cable to have an operating temperature range of -20°C to 75°C.

.5 Cable to be available in 305 m reel in a box.

.6 Cable to be compliant with Manufacturer's performance warranty criteria.

.7 Jacket printed at intervals not exceeding 300 mm indicating cable code, AWG, UL and CSA designations and quarter and year of manufacture.

.1 Jacket colour to be green for data, white for telephone, purple for CCTV and yellow for WAP.

.8 Acceptable material (CAT 6):

.1 Leviton eXtreme #UTP6P-M*S *-color;

.2 Belden GigaFlex 2413;

.3 Panduit PUP6004;

.4 Systimax 1071E.

.2 100 OHM Category 5e U/UTP Balanced Twisted Pair Cable-CMP / FT6 and CSA rated.

.1 Cable shall comply with ANSI/TIA-568.2-D, ISO/IEC 11801, EN50173 Category 5e, IEC 61156-5 standards and be RoHS Compliant.

.2 Cable shall be 4pr 24 awg U/UTP construction.

.3 Cable shall be available in CMP/FT6 fire rating.
.4 Plenum (CMP/FT6) cables shall be cULus listed to UL 444 - CAN/CSA C22.2 No. 214.
.5 Cable to have an operating temperature range of -20 C to 75 C.
.6 Cable to be available in 305 m reel in a box.
.7 Cable to be in (W) White jacket color.
.8 Cable to be compliant with Manufacturer's performance warranty criteria.
.9 Acceptable material (CAT 5e):
.1 Leviton eXtreme # UTP5P-M*S *-color;
.2 Belden GigaFlex 1213;
.3 Panduit PUP5504;
.4 Systimax 2061B.

2.3 DATA/TELEPHONE OUTLETS

.1 Category 6 and 5e Data Outlets
.1 The modular connectors shall be independently tested and verified by a Nationally Recognized Testing Laboratory to meet or exceed the Category 6 component performance requirements of ANSI/TIA-568.2-D.
.2 The connectors shall also be in compliance with US National Electrical Codes; compliant with ANSI/TIA-1096-A (formerly FCC Part 68); UL listed; and independently verified.
.1 IEEE 802.3at (Type 1) Power over Ethernet (PoE) applications up to 15.4 watts.
.2 IEEE 802.3bt (Type 4) Power over Ethernet (PoE+) applications up to 90 watts.
.3 The connector module shall utilize an engineered method to prevent PoE arcing damage from occurring at the critical contact-mating zone between the plug and connector module tines.
.4 The modular connector shall be individual snap-in style.
.5 Termination of all connectors shall be 110-type insulation displacement connectors (IDC).
.6 Rear termination field shall include pointed pair separation towers to promote easier installation.
.7 The connector module shall be designed for use at the work area, communications room and/or equipment room without modification.
.8 Connector wiring is universal and will accommodate installation color codes for T568A and T568B wiring schemes and incorporate Dual-layer T568B/T568A wiring labels.
.9 The termination field shall be 180° configuration such that the punch field is in the back, allowing for easy access rear terminations.
.10 The modular connector shall fit all other installed telecommunications wallplates, outlets and field-configurable patch panels and patch blocks.
.11 The connector module shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
.12 All plastics used in construction of the connector bodies shall be fire-retardant with a UL flammability rating of 94V-0.
.13 Modular outlet color: green for data, white for telephone, purple for CCTV and yellow for WAP.
.14 4-port white interface plate. Provide blanking fillers for unused ports. Interface plate to accept one (1) Category 6 and one (1) Category 5e modular outlets. Where required, provide interface plates that support additional modular outlets.
.15 Acceptable material:
.1 Belden PS6 & PS5e modules c/w 4 port faceplate.

.2 Leviton Extreme 61110-RW6 & 5G110-RW6 module c/w 4 port 42080-4WS faceplate.
.3 Panuit CJ688TP & CJSE88T modules c/w 4 port CFPE faceplate.
.4 Systimax MGS400 & MPS100E Series c/w 4 port M-Series modular faceplate.

2.4 TERMINATION EQUIPMENT FOR TELEPHONE CONDUCTORS

.1 Terminate backbone and telephone cables for fire alarm system on wall mount cross connect system. Provide quantity of components as required.
.2 Terminate new telephone cables on existing BIX field located in main electrical room with TIA/EIA-568-B.2 pin assignment.
.3 The cross-connect system shall be Category 5e 110-style wiring bases, mountable to wall or backboard to provide 110 or BIX termination capable of supporting voice, security, and Category 5e data applications, including high megabit and shared-sheath applications when used with Category 5e rated cabling.
.4 The components shall be UL listed and ANSI/TIA-568-D compliant.
.5 Bases shall support 50, 100 or 300 pair densities with provision for ANSI/TIA-606-C compliant labeling.
.6 Plastic bases and blocks shall be made of fire-retardant plastic rated UL 94V-0.
.7 Wall mount cross connect system comprised of the following components:
.1 Distribution connectors for 25 pair connections.
.2 Mounts for distribution connectors
.3 Designation labels
.4 Designation strips
.5 Distribution rings
.8 Quantities as required, plus 25% spare capacity.
.9 Acceptable Material:
.1 Belden;
.2 Leviton;
.3 Panduit;
.4 Systimax.

2.5 CABLE SUPPORTS

.1 Conduit in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.
.2 J-hook and velcro ties in accordance with Section 27 05 28 – Pathways for Communications Systems.

2.6 UTP WORK AREA CORDS

.1 7' long, colour to match horizontal cabling jacket colour, with factory installed male plugs on both ends to mate with RJ45 jack, Category 6 for data and Category 5e for telephone, 4 pairs: to TIA/EIA-568.2-D.
.2 Provide one patch cord for each data outlet and each telephone outlet.
.3 Specifications to meet UTP cross-connect patch cords above.

2.7 PATCH PANELS

.1 Category 6 for data and Category 5e for telephone modular patch panels, rack mounted, black in colour c/w mounting hardware.
.2 48 port patch panels as indicated with T568A-ISDN wiring assignment. Patch panels to be supplied fully populated with modular outlets.
.3 Mounts in two rack space units (2RU) of a 487mm EIA-310-D compliant rack.
.4 Front and rear port identification complete with labels.
.5 Connectors:
.1 Punch down UTP connector, modular, insulation displacement connection type.

.2 Quiet front, with fully recessed clips.
.3 Built-in wire pair splitters.

.6 Acceptable material:
.1 Belden 48 port FLEX Patch Panel.
.2 Leviton 48 port Quickport patch panel.
.3 Panduit 48 port CPP series patch panel.
.4 Systimax 48 port Patchmax Patch Panel.

2.8 DATA RACK

.1 New 18 rack-unit wall mounted data rack for communications distribution equipment to be 26" wide x 31.5" high x 22" deep, EIA compliant, with a weight capacity of 250 lbs.
.2 Enclosure to be 16-gauge steel, black powder coat finish with a lockable door c/w black plexiglass viewing panel.
.3 Rack to include D-Ring cable management c/w 1/2", 1" and 2" conduit knockouts at top and bottom of back pan.
.4 Acceptable material:
.1 Mid Atlantic #CWR-18-22PD.

2.9 FIBER OPTIC CABLE

.1 Cable to be complete with FR/UV resistant, medium density PE outer jacket, dielectric strength members, ripcord, gel-free, loose tube design and suitable for installation in outdoor environments.
.1 Acceptable material:
.1 12 strand, OS2 single mode fibre, 62.5 micron / 50 micron / 1310 nm /1383 nm / 1550 nm wavelength, 0.4 dB/km / 0.4 dB/km / 0.3 dB/km attenuation.
.1 Corning # 012EU4-T4701D20.
.2 Belden.
.2 6 strand, OM1 multimode fibre, 62.5 micron, 850 nm / 1300 nm wavelength, 3 dB/km / 1 dB/km attenuation.
.1 Corning # 006KU4-T4730D20.
.2 Belden.
.3 All fiber cables are to be mechanically terminated using LC connectors. Any damage, scoring, or pitting to fiber core will require the fiber to be re-terminated by the Contractor, using a new connector at their expense, regardless of test results.

2.10 FIBER OPTIC TERMINATION ENCLOSURES

.1 Fiber Enclosures shall be available in 1RU, 2RU, 3RU, and 4RU versions to accommodate termination and splicing of fibre.
.2 Adapter bulkhead shall accept SC, LC, ST, and MTP® adapters, and plug-n-play MTP modules/cassettes.
.3 Fibre cable management for routing, storage, and protection shall accept patch cords, tight-buffer fibre, and backbone cables.
.4 The rack mount optical fibre Enclosure shall be capable of terminating tight-buffered or loose tube optical fibre cable and support either direct connectorization or fusion slicing.
.5 Splice trays shall be available to support 12 or 24 strands per tray, Heat shrink or Bare fibre splicing and be available in metal or molded plastic design.
.6 Enclosure shall be constructed of 16-gauge steel with a powder-coated black finish and be mountable in either a 19" or 23" rack or cabinet frame.
.7 An optional locking door feature shall be available.
.8 Enclosure shall incorporate a sliding tray (in 1RU & 2RU) that removes completely from Enclosure for ease of field terminations and splicing.
.9 Enclosure shall have removable front and rear covers for better access to interior of Enclosure.

.10 Enclosure shall have removable rubber grommets that allow for pre-terminated fibre trunk install, protection of cable, and minimizes dust build-up.
.11 The Enclosure shall meet or exceed the performance criteria per ANSI/TIA-568.3-D
.12 Acceptable material:
.1 Leviton SDX 1000i enclosures and accessories.

2.11 MODULAR CONNECTORS

.1 Multimode fiber: OM4 multimode, 12 port per frame, LC Duplex Connector c/w dust cap and mounted in 2RU fiber patch housing.
.1 Belden #FF4U12LD- EFICA-VIOLET c/w #AX104682 Housing or approved equal.

2.12 FIBER OPTIC FAN OUT CABLES

.1 Field termination pigtail compatible for use with incoming and distribution fiber optic cabling specified and c/w rubber boots and LC simplex connectors. Minimum length to be 2m and insertion loss no greater than 0.2 dB.
.1 Multimode fiber:
.1 Belden #FT4LC900PR12 or approved equal.

2.13 MANAGED FIBER TO COPPER AND MANAGED COPPER NETWORK SWITCHES

.1 By Others.

2.14 IDENTIFICATION

.1 Each modular jack to be identified with an alpha/numeric label.
.2 Each horizontal cable to have identification markers installed on both ends. Identification markers to be self adhesive vinyl, white background with printed black indelible block lettering.
.3 Each patch panel or termination block to have corresponding labelling. Patch panels are to be labelled A, B, C, etc. with A being located near the top of the rack. The ports on each patch panel are to be labelled 1 to 48.
.4 Labelling to indicate rack number, patch panel letter and outlet number (i.e. 1A48 is rack 1, patch panel A, outlet 48).

3 Execution

3.1 INSTALLATION OF TERMINATION AND CROSS-CONNECT HARDWARE

.1 Install termination and cross-connect hardware on wall or in rack as indicated and according to manufacturers' instructions.
.2 Identify and label as indicated to: TIA/EIA-606-C.

3.2 INSTALLATION OF BACKBONE CABLES

.1 Install backbone cables from telephone service to sub-distribution cross-connect locations.
.2 Terminate both ends.
.3 Identify and label to: TIA/EIA-606-C.

3.3 INSTALLATION OF HORIZONTAL DATA AND TELEPHONE CABLES

.1 Cable shall be installed in accordance with ANSI/NECA/BICSI-568-2006 Standard manufacturer's recommendations and best industry practices.
.2 A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.
.3 Cable raceways shall not be filled greater than the ANSI/TIA-569-E maximum fill for the particular raceway type.
.4 Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

.5 The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.

.6 If J-hooks are used to support cable bundles the J hooks shall be properly sized to accommodate the immediate need and future growth of the cable pathway. J Hooks shall be designed to control bend radius requirements of the cable categories being installed. J hooks shall be installed at intervals of 1m apart to effectively support and distribute the cable's weight and be randomly spaced.

.7 Cable supports shall utilize independent wires, support rods and associated hardware for suspension. At no point shall cable(s) rest on acoustic ceiling grids, T-bars, ceiling support wires, acoustical panels or other components of the suspended ceiling.

.8 The bundle size recommendations of ANSI/TIA TSB-184-A shall be followed as it pertains to current or future support for POE applications.

.9 Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

.10 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

.11 Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568.0-E document, manufacturer's recommendations and best industry practices.

.12 Leave a minimum of 12" of slack for twisted pair cables at the work area outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow-wall installations where box-eliminators are used, excess wire can be stored in the wall. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

.13 When cables are being installed, slack (service loops) shall be provided at both ends to accommodate future changes in the structured cabling system. Slack should be included in all length calculations to ensure that the permanent link does not exceed 90 m (295 ft). The amount of cable slack required will depend on the size and layout of the connecting hardware.

.1 The recommended amount of cable slack shall be:

.1 2m in telecom spaces.

.2 30cm at work area outlet.

.14 Cables shall be neatly dressed at their respective termination device. Each terminating device shall be fed by an individual cable group separated and dressed back to the point of cable entrance into the rack or frame.

.15 Cables shall not be painted.

.16 Each cable shall be clearly labeled on the cable jacket behind the termination device at a location that can be viewed without removing the bundle support ties. Cables labeled where the label is obscured from view shall not be acceptable.

.17 Comply with TIA-569-D recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

3.4 INSTALLATION OF VOICE AND DATA MODULAR JACKS

.1 8-position, 8-contact (8P8C) modular jacks shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

.2 Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

.3 Data jacks, unless otherwise noted in Drawings shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

.4 Termination wire map shall be 568A unless otherwise stated in drawings.

.5 Data jacks shall be plenum rated when installed above ceilings or under raised floors.

3.5 INSTALLATION OF PATCH PANELS

.1 Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568.0-E and/or ANSI/TIA-568.1-D, ANSI/NECA/BICSI-568-2006 and manufacturer's recommendations and best industry practice.

.2 Cables shall be separated into groups of twelve and routed symmetrically from both sides of the patch panel (e.g. split panel).

.3 Cables shall be properly supported vertically in the rack or cabinet and supported at the rear of the patch panel using a cable management bar or a rear horizontal cable management to retain terminations.

.4 Pair untwist at the termination shall not exceed 12mm for Cat 6/5E cabling.

.5 Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

.6 Termination wire map shall be 568A unless otherwise stated in drawings.

3.6 INSTALLATION OF TERMINATION BLOCKS

.1 Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568.0-E, ANSI/TIA-568.1-E, ANSI/NECA/BICSI-568-2006 standard, manufacturer's recommendations and best industry practice.

.2 Pair untwist at the termination shall not exceed 12mm.

.3 Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

.4 Cables shall be neatly bundled and dressed to their respective termination block. Each termination block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

.5 Each cable shall be clearly labeled on the cable jacket within 12" of the termination block at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

.6 Wall mounted termination block fields shall be mounted on communications backboard.

.7 Wall mounted termination block fields shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.7 PATCH CORD INSTALLATION

.1 Patch cords shall be installed at IT room end and at workstation end with cords of appropriate length such that cables are routed through proper cable management ducts and patch ways in a consistent manner. Cords should be routed so as not to block panel labels where possible.

.2 Patch cords shall be installed with the proper color to match the adopted color scheme for the organization.

.3 Patch cords shall be labeled at both ends according to the adopted labeling scheme for the organization. Labeling scheme shall adhere to ANSI/TIA-606-C labeling standard.

.4 Patching schedules and or records shall be updated by the Structured Cabling Plant Administrator after patching has been completed.

.5 Patch cords that are no longer in use shall be removed from the patching frame and properly stored. Patch cords to be harvested for reuse shall have unique ID labeling removed and be retested prior to being made available for re-use.

.6 Plenum rated patch cords shall be used in all above ceiling or raised floor applications.

3.8 IMPLEMENT CROSS-CONNECTIONS

.1 Implement cross-connections using jumper wires as specified.

3.9 INSTALLATION OF DIRECT BURIED FIBRE CABLE

.1 Install fibre cable as indicated and to manufacturer's recommendations.

3.10 OPTICAL FIBRE PANELS/ENCLOSURES

.1 Cables shall be dressed and terminated in accordance with manufacturer's recommendations and best industry practices.
.2 Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
.3 Bend radius of the optic Fibre cable in the panel/enclosure shall not exceed 10 times the outside diameter of the cable.
.4 Each Fibre bundle shall be stripped upon entering the splice tray and the individual fibres routed in the splice tray.
.5 Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.
.6 A maximum of 12 strands of Fibre shall be spliced in each tray.
.7 All spare strands shall be installed into spare splice trays.
.8 Fibre slack shall be neatly coiled within the Fibre splice tray or enclosure. No slack loops shall be allowed external to the Fibre panel.
.9 Installer will visually clean and inspect fibre connector endface prior to insertion into coupler plate.
.10 Installer will attach dust caps immediately after endface inspection and after testing.

3.11 OPTICAL FIBRE CONNECTORS AND PIGTAILS

.1 All optical fibre shards shall be properly disposed in an approved container to prevent injury. The use of tape is not an approved method for disposal.
.2 Application of direct connect fibre connectors (crimp, adhesive or anaerobic) shall be done in accordance with manufacturer's instructions and industry best practice.
.3 Pigtails shall be installed with appropriate fusion splicing equipment that has been calibrated per manufacturer's recommendations.
.4 After polishing/splicing is completed, optical fibre connectors shall be visually checked with an inspection scope (min x200) for damage and debris.
.5 If the optical fibre core is fractured, chipped or scratched it must be re-terminated.
.6 Dust caps to be installed immediately after inspection and insertion into coupler plates.

3.12 OPTICAL FIBRE PATCH CORDS

.1 Fibre patch cords/workstation cords shall be installed as per the requirements specified by the manufacturer's installation guidelines.
.2 Installer will visually inspect and clean fibre connectors at every stage of handling BEFORE mating them.
.3 Inspection of both endfaces (Cord end and internal Bulkhead) before mating patch cords is required.
.4 Cleaning both connectors each time you disconnect and reconnect is required.
.5 Inspection and cleaning of simplex fibre interfaces will adhere to the procedures detailed in International Standard IEC 61300-3-35.
.6 Objective inspection tools shall be used to perform endface inspection.

3.13 FIELD QUALITY CONTROL

.1 Test backbone UTP cables as specified below and correct deficiencies. Provide a record of results both hard copy and electronic on CD.
.2 Contractor to provide map of the data and telephone outlet numbering and cable pathway on 11" x 17" (or larger) copy of the building floor plan for each associated rack. Submit marked up floor plans in accordance with Division 01 - General Requirements.
.3 Test 100 percent of all new and modified communications cable runs for defects in installation and verify cabling system performance under installed conditions in accordance with ANSI/TIA-568.0-D standards.

.4 Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.

.5 Performance Certification Testing of Twisted-Pair Cables: (NOTE: Permanent Link Test results are recommended and are the expected norm).

.1 Test 100 percent of all new and modified communications cable runs for defects in installation and verify cabling system performance under installed conditions in accordance with ANSI/TIA-568.0-D standards.

.2 Test horizontal cabling using approved certification tester for Category 6/5E performance in accordance with ANSI/TIA-568.0-D. Level IIIe tester for Cat 6 and Level IIe tester for Cat 5E shall be used

.3 Basic Tests Required:

.1 Wire map.
.2 Length (feet).
.3 Insertion loss (dB), formerly attenuation.
.4 NEXT (Near end crosstalk) (dB).
.5 Return loss (dB).
.6 ELFEXT (dB).
.7 Propagation delay (ns).
.8 Delay skew (ns).
.9 PSNEXT (Power sum near-end crosstalk loss) (dB).
.10 PSELFEXT (Power sum equal level far-end crosstalk loss) (dB).

.4 Test Category 6/Class E by auto test to 250 MHz. Test Category 5E auto test to 100Mhz.

.5 Provide test results in approved certification testers original software format on CD, with the following minimum information per cable:

.1 Circuit ID.
.2 Information from specified basic tests required.
.3 Test Result: "Pass" or "Fail".
.4 Date and time of test.
.5 Project and time of test.
.6 NVP.
.7 Software version.

.6 Submit fully functional version of tester software for use by the Owner in reviewing test results.

.7 Report in writing to the Owner immediately, along with copy of test results, failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs).

.6 Test Optical-fibre strands for attenuation to: TIA/EIA-568-D.1 and correct deficiencies: provide record of results as hard copy and electronic record on CD.

.1 Testing procedures shall be in accordance with the following:

.1 ANSI/TIA-568.3-D.
.2 ANSI/TIA-526-7, Method B.
.3 Proposed TSB-140 Tier One Fibre Certification, C.
.4 Encircled Flux testing per the TSB-4979 and TIA-526-14-B standard.

.2 Testing:

.1 Test optical fibres at both 850 nm and 1300 nm wavelengths for multimode, 1310 nm and 1550 nm wavelengths for singlemode, end-to-end insertion loss.

.2 Maximum channel insertion loss for fibre optic cables without consolidation point: 2.0 db.

.3 All OLTS units shall be of current calibration, submit calibration certificate with test results to Manufacturer.

.7 Contractor to provide map of the data and telephone outlet numbering and cable pathway on 11" x 17" (or larger) copy of the building floor plan for each associated rack. Submit marked up floor plans in accordance with Division 01 - General Requirements.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.
.2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
.3 Section 27 05 14 - Communication Cables - Inside Buildings.

1.2 REFERENCES

.1 Industry Canada - Terminal Attachment Program
  .1 CS-03, Telecommunication Apparatus Compliance Specification, Issue 8.

1.3 SYSTEM DESCRIPTION

.1 Modifications and additions to the existing mass notification system installed in the building.
.2 Operations:
  .1 Emergency page to all Holland College areas in the building.
.3 Mass notification system equipment is to be Owner supplied and Contractor installed.

2 Products

2.1 MATERIALS

.1 Conduits: to Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
.2 Communication conductors: as indicated, to Section 27 05 14 - Communication Cables - Inside Buildings.
.3 Antenna: to Section 27 53 20 - Master TV Antenna.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for public address system installation in accordance with manufacturer's written instructions.
  .1 Visually inspect substrate.
  .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Obtain complete installation and wiring requirements from manufacturer prior to rough-in.
.2 Install equipment as indicated and in accordance with manufacturer's instructions.
.3 Demonstrate the complete sequence of operation.
.4 Instruct the Owner in the operation and programming of the system. Manufacturer’s factory service engineer to allow for visit three (3) months after occupancy to modify programming to suit requirements of the owner following trial usage of the system. Schedule 3-month turnover visit prior to sign-off.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
.2 Test complete system, including control intelligibility tests, under actual working conditions, in presence of, and to satisfaction of, Engineer-Architect. Reference EASE model in all findings.
.3 Test broadcast range of transmitter and adjust antenna for optimum results.
.4 Check out complete system for operational sequencing.
.5 DSP to be fully configured for proper functionality and once complete, security lockout enabled.

.6 Automatic Resonance Control (ARC), Feedback Suppression (FBS), speaker Parametric Equalizer Adjustment (PEQ's) and complete Equalization (EQ) on inputs and outputs.
.7 Delays set up according to distance/scenes.
.8 Proper scene setting to be configured for gym spaces and controllers to be labeled.
.9 Input selection devices to be configured for gym and cafetorium spaces and controllers to be clearly labeled.
.10 System user reference manual to be provided specific to supplied system in addition to standard user manual.
.11 Submit to Engineer-Architect and Commissioning Agent one (1) copy of (each) test result signed off by manufacturer's representative verifying that all components of the system are installed and working correctly.
.12 Function verification of system by Commissioning Agent will follow Contractor's commissioning.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 08 71 00 - Door Hardware.
.2 Section 26 05 00 - Common Work Results - Electrical
.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCE STANDARDS

.1 National Fire Protection Association (NFPA)
  .1 NFPA 71- Standard from the Installation, Maintenance and Use of Signaling Systems for Central Station Services.
.2 Underwriter’s Laboratories Canada (ULC)
  .1 CAN/ULC S304, Standard for control and monitoring station burglar alarm units.
  .2 CAN/ULC S561, Installation and Services for Fire Signal Receiving Centres and Systems.

1.3 DESCRIPTION OF SYSTEM

.1 Provide a complete access control system to continuously monitor and control access to the building.
.2 Provide the necessary hardware to communicate intrusion information to a certified monitoring agency.
.3 Access control system to consist of but is not limited to, door control panels, card readers, request-to-exit motion detectors, door contacts.
.4 Door hardware including electric strikes and electrified hardware is to be supplied and installed by Division 08. Refer to Section 08 71 00 and associated door hardware schedule for detailed information.
.5 Commission and provide programming of the system in accordance with the Owner's security and access control requirements.
.6 The access control system is to allow entry to restricted areas. When an authorized card is presented to the card reader, the electric strike is released and the card holder opens the door. Egress from these areas is to be unrestricted by the access control system. Refer to Details on the Drawings for access control functionality of specific doors.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .1 Include wiring diagrams and riser schematics indicating location of controllers and devices for review and approval by the Consultant.

1.5 WARRANTY

.1 Submit manufacturer's warranty document executed by an authorized company or official stating that the access control system is warranted against defects in operation, material and workmanship for a period of one year from date of signed off substantial completion. Include system warranty document in Maintenance Manuals.

2 Products

2.1 DOOR CONTROLLER

.1 Each door, four (4) door controller to be capable of interfacing with a minimum eight (8) peripheral access control readers and a separate intrusion alarm system and/or other door controllers where indicated.

.2 Sixteen (16) monitored points, a minimum of four (4) form 'C' control relay outputs, and sixteen (16) open collector outputs.
.3 128 KB RAM and 256 KB of flash memory c/w battery backup.
.4 Integrated remote workstation interface through IP or RS-232 connection.
.5 Integral 16 V, 40 VA transformer with 12 V, 7 Ah supervised battery backup.
.6 Lockable CSA type 1 enclosure c/w tamper switch.
.7 Minimum eight (8) zone programmable input expansion module to monitor intrusion devices.
.8 Coordinate and establish communications between access control panel and with Owner's specified monitoring agency.
.9 12 V, 250 mA supervised door strike power output.
.10 System to provide a minimum of:
  .1 1,000 users.
  .2 20,000 events.
  .3 20 schedules.
  .4 25 holidays.
.11 Acceptable material:
  .1 Kantech #KT-400, complete with alarm panel integration kit, #KT-Tamper (tamper switch), #KT-BATT (battery).

2.2 KEYPAD

.1 Backlit, 2-line, 32-character LCD display.
.2 Zone status, system status, trouble, event buffer, and date and time display with Ready, Armed and Trouble LED's.
.3 5 programmable function keys and keypad activated alarms.
.4 Tamper switch.
.5 Acceptable material:
  .1 Kantech #KT3-LCD.

2.3 DOOR CONTACTS

.1 Recess mounted in door frame for detection when door is open.
.2 Magnetic type, 30 VDC, 3 W max, double pole as required to connect to access control and intrusion alarm systems.
.3 Tamper switch.
.4 Acceptable material:
  .1 G.E. #1078CTW Series.

2.4 MOTION DETECTORS

.1 Passive infrared technology with sensitivity adjustment.
.2 Wall or ceiling mounted as indicated.
.3 Tamper switch
.4 Coverage pattern as required.
.5 Acceptable material:
  .1 DSC Bravo Series.

2.5 PROXIMITY CARD READERS

.1 Impact resistant polycarbonate housing suitable for interior and exterior installations.
.2 Capable of being mounted to metal door mullions.
.3 Audible and visual operation through LED indicators and internal buzzer.
.4 125 kHz HiD operation capable of a 6" read range.
.5 Acceptable material:
  .1 Kantech #Shadow Prox SH-XL.

2.6 WIRING

.1 Wiring and cables in accordance with the recommendations of the approved system manufacturer. Typical FT4 rated access control cabling as follows:

DESCRIPTION	WIRE TYPE	PART #
Door Controller Network Cable	2 Pair #24 Shielded	Provo #5402
Door Controller Power Cable	2C#16 AWG	Provo #9162
Card Readers / Keypads	6C#18 AWG Shielded	Provo #6506
Door Contacts	2C#22 AWG	Provo #9222
Electric Latch Retraction	5C#18 AWG	Provo #9185
Electric Strikes	2C#18 AWG	Provo #9182

2.7 FIRE ALARM INTEGRATION

.1 Provide connection between the fire alarm control panel and the fire alarm signal transmitting unit.

.2 Upon activation of the fire alarm system, the fire alarm control panel is to release locking mechanisms on all access controlled doors, and notify the central monitoring facility of the event.

3 Execution

3.1 INSTALLATION

.1 Install all wiring, raceway, outlet boxes, panels and devices including any miscellaneous material to constitute complete system as indicated.

.2 Install conduit from access control devices located in walls and door frames to door control panel location without splices where possible. Where splicing or junctions are required on access control cabling, use junction boxes with clearly identified terminal strips. Wire nuts will not be permitted. Rough-in device boxes for card readers and access control devices as required.

.3 All access control cabling is to be installed in conduit in accordance with Specification Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings. Conceal conduit in inconspicuous but accessible locations where possible.

.4 Supply and install access control cabling from field mounted devices to door control panels.

.5 Terminate access control cabling on field mounted devices in accordance with manufacturer's instructions.

.6 Supply and install network cable interconnecting all door control panels and to Owner supplied workstation in accordance with manufacturer's instructions.

3.2 VERIFICATION AND COMMISSIONING

.1 Arrange and include an 8-hour site visit by the Manufacturer's Technical Representative to verify, commission, program the system and demonstrate the operation of the system to the Owner. Provide manufacturer's verification certificate in the Maintenance Manuals. Verification to include but is not limited to:

- .1 Compliance with manufacturer's specification, product literature and installation instructions.
- .2 Operation of each device individually and within its environment.
- .3 Operation of each device in relation with programmable schedule and or/specific functions.

.2 Coordinate with Owner to determine exact system requirements such as scheduling, zone identification, etc., and program system to the Owner's specific requirements.

.3 On behalf of the Owner make all arrangements for 24 hour remote monitoring at location of Owner's choice and verify that alarm signal is received.

3.3 CLEANING AND ADJUSTING

.1 Remove protective coverings from control panels, detection accessories and components.
.2 Adjust all components for correct function.

END OF SECTION

1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical
.2 Section 26 05 31 - Splitters, Junction andPull Boxes
.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

1.2 REFERENCE STANDARDS

.1 Underwriters Laboratories of Canada (ULC)
  .1 CAN/ULC-S304, Intrusion Detection.
  .2 CAN/ULC-S306, Intrusion Detection Units.
  .3 ULC-S318, Power Supplies for Burglar Alarm Systems.
  .4 CAN/ULC-S561, Installation and Services for Fire Signal Receiving Centres and Systems.

1.3 DESCRIPTION OF SYSTEM

.1 Provide a complete intrusion monitoring and alarm system which is expandable and easily modified for inputs, outputs and remote control stations.
  .1 Modified system to be in accordance with CAN/ULC-S306 and be capable of:
    .1 Annunciating undesirable, abnormal or dangerous conditions.
    .2 Prioritizing alarms by alarm type; i.e. panic/duress, intrusion and tamper.
    .3 Determining and annunciating zone where an alarm occurred.
    .4 Annunciating power failure and power restoration.
    .5 Annunciating low battery condition.
    .6 Operating continuously for minimum period of 6 hours in the event of a power failure.
    .7 Alarm masking.
    .8 Remote maintenance or diagnostics with password activation.
    .9 Assigning a unique identifier for each authorized person.
    .10 Manual and automatic arming and disarming by time of day, day of week, or by operator command.
    .11 Supporting both manual and automatic responses to alarms entering system.
.2 Control panels to be provided with continuous tamper detection.
  .1 Tamper detection to trigger alarm and trouble light.
.3 Communications link to be security level of I in accordance with CAN/ULC-S304.
.4 Signal link to be security level of I in accordance with CAN/ULC-S304.
.5 Time for an alarm to be communicated from alarm initiation to annunciation at remote monitoring location is no greater than 60 seconds.
.6 Power supplies to be rated to provide cumulative load of all systems components plus safety factor of 50% or greater.
.7 Provide the necessary hardware to communicate intrusion information to a certified monitoring agency.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  .1 Include wiring diagrams, detection device coverage patterns and zone layout drawing indicating number and location of zones and areas covered.

1.5 WARRANTY

.1 Submit manufacturer's warranty document executed by an authorized company or official stating that the entire system is warranted against defects in operation, material and

workmanship for a period of one year from date of signed off substantial completion of the project. Include system warranty document in Maintenance Manuals.

2 Products

2.1 MATERIALS

.1 Control Panel:
- .1 Minimum of 6 on-board zones, expandable to accommodate a minimum of 16 hardwired zones.
- .2 Power supply to be 16 VAC, 40 VA, 60 Hz in accordance with ULC-S318. Batteries to be sized for system to operate continuously for 6 hours in the event of a power failure.
- .3 Number of user codes: 48.
- .4 Number of partitions required: 2.
- .5 Keypads: up to 8 hardwired.
- .6 Capable of communicating with Owner's specified monitoring agency through PSTN dual line dialer or with GPRS or IP.
  - .1 Fire alarm signal transmitting unit and all associated connections to the fire alarm control panel are to be completed in accordance with CAN/ULC-S561. Refer to Specification Section 28 31 00 - Fire Detection and Alarm for additional information.
- .7 System: Conventional, Hardwired.
- .8 500-event buffer.
- .9 Number of programmable outputs: 2, expandable to 14.
- .10 System supervision: telephone line, battery, and AC power.
- .11 Notification output: 12 VDC at 700 mA (continuous).
- .12 CSA Type 1 lockable enclosure sized to accommodate power supply, batteries and one 8 zone expansion board. Enclosure to be c/w tamper switch.
- .13 Acceptable material:
  - .1 DSC #PC1616. [DESIGN NOTE: Neo Series to replace PCS4020]
  - .2 DSC #KIT16-412C c/w fire alarm transmitting unit. [DESIGN NOTE: GPRS or IP]

.2 Keypads:
- .1 Backlit, 2-line, 32-character LCD display.
- .2 Zone status, system status, trouble, event buffer, and date and time display with Ready, Armed and Trouble LED's.
- .3 Tamper switch.
- .4 5 programmable function keys and keypad activated alarms.
- .5 Acceptable material:
  - .1 DSC #LCD4501.

.3 Conventional Devices:
- .1 Motion Detectors:
  - .1 Passive infrared technology with sensitivity adjustment.
  - .2 Wall or ceiling mounted as indicated.
  - .3 Tamper switch.
  - .4 Coverage pattern as required.
  - .5 Acceptable material:
    - .1 DSC Bravo Series.
- .2 Door Contacts:
  - .1 Recess mounted in door frame for detection when door is open.
  - .2 Magnetic type, 30 VDC, 3 W max, double pole as required to connect to access control and intrusion alarm systems.
  - .3 Tamper switch.
  - .4 Acceptable material:

.1 E. #1078CTW Series, c/w DSC #AMP-701 addressable module.

.4 Audible Notification:
- .1 30 W siren with 120 dB yelp or steady signal.
- .2 Impact resistant white plastic housing.
- .3 Mount horns in accessible ceiling space.
- .4 Acceptable material:
  - .1 DSC #SD30W.

3 Execution

3.1 INSTALLATION

.1 Install intrusion alarm system panels(s) and devices in accordance with manufacturer's written installation instructions at locations, heights and surfaces as indicated.

.2 Conceal junction boxes in inconspicuous but accessible locations in accordance with Specification Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.3 Conceal conduit and wiring where possible. All wiring to be in conduit installed in accordance with Specification Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.2 VERIFICATION AND COMMISSIONING

.1 Arrange and include an 8-hour site visit by the Manufacturer's Technical Representative to verify, commission, program the system and demonstrate the operation of the system to the Owner. Provide manufacturer's verification certificate in the Maintenance Manuals. Verification to include but is not limited to:
- .1 Compliance with manufacturer's specification, product literature and installation instructions.
- .2 Operation of each device individually and within its environment.
- .3 Operation of each device in relation with programmable schedule and or/specific functions.

.2 Coordinate with Owner to determine exact system requirements such as scheduling, zone identification, etc., and program system to the Owner's specific requirements.

.3 Make connection to remote monitoring station on behalf of the Owner, make all arrangements for 24 hour remote monitoring at location of Owner's choice and verify that alarm signal is received. Include for one (1) year of monitoring service in total tender price.

3.3 CLEANING AND ADJUSTING

.1 Remove protective coverings from control panels, detection accessories and components.

.2 Adjust all components for correct function.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.
.2 Section 27 10 05 - Structured Cabling for Communication Systems.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)
  .1 CSA C22.1-24, Canadian Electrical Code, Part 1 Safety Standard for Electrical Installations.
.2 Underwriters Laboratories of Canada (ULC)
  .1 ULC-S317, Installation and Classification of Closed Circuit Video Equipment (CCVC) Systems for Institutional and Commercial Security Systems.

1.3 DESIGN PERFORMANCE REQUIREMENTS

.1 Digital pan, tilt, and continuous 8X zoom, with full image recording in the background.
.2 Provision to switch to and monitor any camera in system manually or automatically on a pre-programmed schedule.
.3 Enter and edit surveillance programs and save them for future use.
.4 Set dwell time for viewing of any camera picture.
.5 Define sequence for viewing cameras.
.6 Bypass cameras in system during sequencing to monitor.
.7 Provide ability to display stored or real-time camera image at a local station or remotely over the network.
.8 Overall control of surveillance system provided through software control, which provides complete integration of all components.
.9 Integreted NVR and PoE switch configuration, size and capacity as indicated.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
.2 Shop drawings to indicate project layout, camera locations, point-to-point diagrams, cable schematics, risers, mounting details and identification labeling scheme including:
  .1 Functional description of equipment.
  .2 Technical data sheets of all devices.
  .3 Device location plans and cable lists.
  .4 Video camera surveillance chart.
.3 Maintenance Data: Submit maintenance data for incorporation into manual specified in Division 01 - General Requirements - Closeout Submittals. Include following:
  .1 Instructions on operation, adjustment and cleaning.
  .2 Illustrations and diagrams to supplement procedures.
  .3 Manufacturer's operation and maintenance instructions.

1.5 WARRANTY

.1 Manufacturer's Warranty: Submit, for Owner’s Representative's acceptance, manufacturer's warranty document executed by authorized company official, stating that the video surveillance system is warranted against defects in operation, material and workmanship for a period of 12 months from the date of substantial completion of the project.

2 Products

2.1 MATERIALS

.1 PoE Network Camera:
- .1 Minimum light intensity:
  - .1 0.25 lux, (colour); 0.05 lux (B/W).
- .2 Resolution: Minimum of 5 variable settings with a minimum resolution of 2592 x 1944, selectable frame rate with 30 fps max.
- .3 Lens:
  - .1 Exterior: f/1.8, 90°(H) x 60°(V) wide angle.
  - .2 Interior: f/1.8, 55°(H) x 41°(V).
- .4 Mounting: Pendant. Provide pole mount installation brackets for pole mounted cameras.
- .5 Supported protocols: TCP/IP, UDP, ICMP, IPv4, SNMP, HTTP, HTTPS, SSL, SSH, SMTP, FTP, RTSP, UPnP, DNS, NTP, RTP, RTCP.
- .6 Operational voltage: PoE (IEEE802.3af, class 3); 24 VAC nominal; 18 to 32 VAC range.
- .7 Power consumption: less than 8 W nominal.
- .8 Environment: Camera components and systems to operate with all specified requirements under following ambient temperatures:
  - .1 Outdoor installations:
    - .1 Temperature: -40°C to 50°C
    - .2 Humidity: 15 to 85%
- .9 Camera Housings:
  - .1 Exterior: Equipped with IP 66 weather tight back box and enclosure.
- .10 Transmission Methods: CAT 6 cable or better and RJ-45 network port.
- .11 Configurable frame rates and bit rates for bandwidth administration.
- .12 Capable of backing up and restoring factory or user defined camera settings through embedded software.
- .13 Acceptable material:
  - .1 Panasonic.
  - .2 Axis Communication.

.2 External Storage
- .1 Network Video Recorder / Network Attached Storage (NAS) Server
  - .1 Support recording of JPEG, MPEG-4, H.264 and other compatible IP streams.
  - .2 Minimum total system storage of 6TB via hot-swappable harddrives, two gigabit Ethernet RJ-45 ports, one for camera data and one for network connection, rack mountable chassis.
- .2 IP Video Management Software
  - .1 Capable of running client applications as well as video management system.
  - .2 A remote client computer with system compatible software will be the interface for viewing and control of the system. Non-expiring software licenses to be purchased by the Client in quantities as required.
  - .3 Software functions are to include but not be limited to, screen layout selection, time and date search, digital PTZ control, video stream modification for bandwidth administration, and on-the-fly changes such as frame rate, frame size.
  - .4 Include non-expiring camera licenses as required to accommodate all IP cameras for a complete system as indicated.
  - .5 Remote client PC's to be supplied and installed by others. PC to accommodate video management software requirements.

2.2 RACK MOUNT POE SWITCH

.1 8-port IEEE 802.3 af/at compliant, rack mounted managed PoE switch compatible with IP cameras and surveillance system as indicated. Switch to be capable of 15.4 W of power per port, auto-negotiation, non-blocking 200 mbps bandwidth in full duplex mode, rack mountable, LED indicator lights.

.2 Acceptable material:

.1 INAXSYS #IN-882POE.

2.3 REMOTE POE SWITCH

.1 Not applicable.

3 Execution

3.1 INSTALLATION

.1 Supply and install video surveillance equipment and components in accordance with ULC-S317.

.2 Supply and install all required cabling, patch cords, boxes, mounting hardware, brackets, cameras and system components as required for a fully functional video surveillance system in accordance with manufacturer's written installation instructions.

.3 Supply and install components secure, properly aligned and in locations shown on reviewed shop drawings.

.4 Connect network camera system distribution equipment and cabling in accordance with Specification Section 27 10 05 - Structured Cabling for Communication Systems, and manufacturer's wiring and installation instructions.

.5 Jacket color for all CCTV communications cabling to be yellow.

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's Services:

.1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 Provide for manufacturer's certified technician to visit, program, commission, and verify complete camera system and software. Schedule and provide for a system configuration and software/hardware training session given by the manufacturer's certified technician to the Client. System software to be configured to the specific Client requests.

3.3 CLEANING AND ADJUSTING

.1 Remove protective coverings from cameras and components.

.2 Adjust cameras for correct function.

.3 Clean camera housing, system components and lens, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

END OF SECTION

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1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results - Electrical.

1.2 SUMMARY

.1 Section Includes:
- .1 Materials and installation for fire alarm systems.
- .2 Manual alarm stations.
- .3 Automatic alarm initiating devices.
- .4 Audible signal devices.
- .5 End-of-line devices.
- .6 Visual alarm signal devices.
- .7 System operation.
- .8 Verification.
- .9 Control panels.
- .10 Fire alarm signal transmitting unit.
- .11 Fault isolators.
- .12 Addressable interface modules.
- .13 Passive graphic display.

.2 General Requirements
- .1 This specification details the supply, installation commissioning and verification of an existing single-stage, addressable fire alarm initiation and notification system for the Holland College Greenbuild Campus in Summerside, PEI.
- .2 The manufacturer is required to identify any areas of the specification where they do not completely comply.
- .3 The fire alarm system must include all the necessary electronic hardware, software, and memory for a completely operable system in accordance with these specifications and associated drawings, to perform the functions described herein.
- .4 Device and equipment locations are approximate only and must be field verified prior to tendering and the tender price adjusted to cover actual conditions.
- .5 Install all new wire, conduit, and fire alarm devices in accordance with the drawings and specifications. The actual device, equipment, and wiring layout will be the manufacturer's responsibility and detailed wiring and installation drawings must be provided.

1.3 REFERENCES

.1 Government of Canada
- .1 NBC-2020 National Building Code of Canada.
- .2 NFC-2020 National Fire Code of Canada.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

.3 Underwriter's Laboratories of Canada (ULC)
- .1 CAN/ULC-S524: 2019, Standard for the Installation of Fire Alarm Systems.
- .2 CAN/ULC-S525: 2016, Audible Signal Device for Fire Alarm Systems.
- .3 CAN/ULC-S526: 2016, Visual Signal Devices for Fire Alarm Systems.
- .4 CAN/ULC-S527: 2019, Control Units.
- .5 CAN/ULC-S528-14, Manual Pull Stations for Fire Alarm Systems.
- .6 CAN/ULC-S529: 2016, Smoke Detectors for Fire Alarm Systems.
- .7 CAN/ULC-S536: 2019, Inspection and Testing of Fire Alarm Systems.
- .8 CAN/ULC-S537: 2019, Verification of Fire Alarm Systems.
- .9 ULC-S548-15 (R2020), Alarm Initiating and Supervisory Devices for Water Type Extinguishing Systems.

.10 CAN/ULC-S559: 2020, Equipment for Fire Signal Receiving Centres and Systems.
.11 CAN/ULC-S561: 2020, Installation and Services for Fire Signal Receiving Centres and Systems.
.4 National Fire Protection Agency (NFPA)
.1 NFPA 72-2022, National Fire Alarm Code.
.2 NFPA 90A-2021, Installation of Air Conditioning and Ventilating Systems.
.3 NFPA 101-2021, Life Safety Code.
.5 International Standard Organization (ISO)
.1 ISO 8201, Acoustics - Audible Emergency Evacuation Signal.

1.4 SHOP DRAWINGS

.1 Shop Drawings:
.1 Submit shop drawings and product data for all fire alarm equipment and devices in accordance with Division 01 - General Requirements.
.1 All fire alarm equipment and devices.
.2 Include:
.1 Layout of equipment.
.2 Zoning.
.3 Complete wiring diagram, including schematics of modules.
.3 Quality assurance submittals: submit following in accordance with Division 01 - General Requirements.
.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.
.3 Manufacturer's Field Reports: manufacturer's field reports specified.
.4 Closeout Submittals:
.1 System wiring diagrams:
.2 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.
.3 Show modules, relays, switches and lamps in control panel.
.4 Power Calculations:
.1 Submit design calculations for new work specified to substantiate that battery capacity exceeds supervisory and alarm power requirements.
.2 Show comparison of detector power requirements per zone versus control panel smoke detector power output per zone in both standby and alarm modes for zones affected by the renovations.
.3 Show comparison of notification appliance circuit alarm power requirements with rated circuit power output for notification circuits affected by the renovations.

1.5 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company or person specializing in fire alarm system installations with five (5) years documented experience approved by manufacturer.
.2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.
.3 System:
.1 In accordance with applicable Codes, Standards and the Authority Having Jurisdiction.
.4 Maintenance Service:

.1 Provide one (1) year's free maintenance based upon 24 hour emergency service with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536 and CAN/ULC-S561. Submit inspection report to Engineer.

2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
.2 Audible signal devices: to CAN/ULC-S525.
.3 Visual signal devices: to CAN/ULC-S526.
.4 Control Panel: to CAN/ULC-S527.
.5 Manual pull stations: to CAN/ULC-S528.
.6 Smoke detectors: to CAN/ULC-S529.
.7 Signal transmitting unit: to CAN/ULC-S599.

2.2 DESCRIPTION OF WORK

.1 This specification details the supply, installation commissioning and verification of a new single-stage, addressable fire alarm initiation and notification system for Holland College Greenbuild Campus in Summerside, PEI.
.2 Modifications and additions to the existing fire alarm initiation and notification system at the Holland College Greenbuild Campus.
.3 Installation, commissioning and verification of new and modified fire alarm system devices and wiring.
.4 The existing fire alarm control panel location within the main Electrical Room is to be verified on site. The existing fire alarm control panel is to be reused, along with all the existing fire alarm protection functions including receiving alarm signals, initiating general alarms, supervising the system continuously, actuating zone annunciators, and initiating trouble signals unless otherwise indicated.
.5 Installation to proceed on the basis that the building is fully occupied and retrofit of the existing fire alarm system will be implemented in a manner to minimize disruption of day-to-day operations and personnel within the building.
.6 During the retrofit, fire protection must be maintained throughout all areas of the building, and is to conform to the following standard: NFPA 101: 9.6.1.7 - Fire Alarm System Shutdown which states: "Where a required fire alarm system is out of service for more than 4 hours in a 24-hour period, the authority having jurisdiction is to be notified and the building must be evacuated or an approved fire watch must be provided for all parties left unprotected by the shutdown until the fire alarm system has been returned to service." As the building cannot be evacuated the Contractor must provide an approved fire watch when necessary and the fire watch must be provided using security cleared and qualified personnel. The Contractor is to carry the full cost for fire watch in the tender price.
.7 As required, install temporary covers on existing spot type fire alarm detectors to prevent false alarms during supervised work.

2.3 SYSTEM OPERATION

.1 Actuation of any alarm initiating device to:
  .1 Indicate type of alarm and location at control panel and remote annunciators.
  .2 Cause audible signaling devices to sound throughout the building and at the control panel.
  .3 Cause visual signals to flash self-synchronizing strobes continuously throughout the building.
    .1 Where new devices are installed on existing notification loops, synchronizing devices are to be provided or additional conductors connected to provide

synchronized notification throughout the visible area in accordance with CAN/ULC-5524 Article 5.4.5.2.

.4 Transmit signal to fire receiving centre via central station and signal transmitting unit.

.5 Cause air conditioning and ventilation fans to shut down or to function to provide required control of smoke movement.

.6 Release fire / smoke control door hold-open devices.

.2 Actuation of second stage alarm to:

.1 Cause audible and visual signaling devices to activate throughout the building that the alarm initiated.

.3 If the first stage alarm is not acknowledged in two minutes, system to automatically go into second stage.

.4 Acknowledging alarm: indicated at control panel.

.5 Possible to silence signals by "alarm silence" switch at control unit after 60 second period of operation.

.6 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.7 Actuation of supervisory devices to:

.1 Indicate type of supervisory device and location at control panel and where applicable, at remote annunciator.

.2 Cause audible signal at control panel to sound.

.3 Activate common supervisory sequence.

.8 Resetting alarm or supervisory device not to return system indications/functions back to normal until control panel has been reset.

.9 Trouble on system to:

.1 Indicate device and circuit in trouble at control panel.

.2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication, whereas visual indication to remain until trouble is cleared and system is back to normal.

.10 Trouble on system: suppressed during course of alarm.

.11 Trouble condition of any circuit in system not to initiate alarm conditions.

2.4 SYSTEM TESTING BYPASS MODULE

.1 Provide a control display module with 4 auxiliary switches/LED’s which can be programmed to bypass annunciation circuits, municipal connection and remote relay functions as required for system maintenance/testing.

2.5 REMOTE ANNUNCIATORS

.1 Provide remote alpha-numeric display annunciators with supervised Class B serial connections to the control panel. Operate on nominal 24VDC with battery back-up.

.1 Provide a back-lit, alpha-numeric, 80 character, liquid crystal display. Coordinate point messages with the control panel.

.2 Display system normal, alarm, trouble and supervisory LED's. Provide a key switch to enable reset, alarm, trouble, silence, trouble silence and drill switches.

.3 Mount the annunciators as indicated on the plans.

.4 Minimum wiring configuration with main panel and other remote annunciators.

2.6 INITIATING / INPUT CIRCUITS

.1 Receiving circuits for alarm initiating devices such as manual pull stations and smoke detectors to be, wired in a Class A configuration to control panel.

.2 Alarm receiving circuits: compatible with smoke detectors and open contact devices.

.3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".

.4 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

2.7 ALARM OUTPUT CIRCUITS

.1 Alarm output circuits: connected to output or notification devices, wired in Class A, configuration to the control panel.
  .1 Signal circuit operation to follow system programming, capable of sounding signals either continuously, at 20spm or using a temporal pattern as described by International Standard ISO 8201, Acoustics - Audible Emergency Evacuation Signal and continuously flashing visual signals. Each signal circuit rated at 6 A, 24 VDC, fuse protected from overloading/overcurrent.
  .2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

2.8 WIRING

.1 Wire type and number of conductors as recommended by fire alarm equipment manufacturer.
.2 To initiating circuits: Power limited fire alarm armoured cable or in conduit, twisted or untwisted, shielded or unshielded, copper conductors #18 AWG minimum, 300 V, FT4 rated to: CSA C22.2 No. 208-03, FAS 105°C.
.3 To signal circuits: 14 AWG, RW90 minimum and in accordance with manufacturer's requirements for voltage drop.
.4 To control circuits: 14 AWG, RW90 minimum and in accordance with manufacturer's requirements.

2.9 MANUAL ALARM STATIONS

.1 Addressable manual pull station: pull lever, surface semi-flush, wall mounted type, double action, two stage, bilingual English/French signage, and electronics to communicate station's status to addressable module. Station address to be set on station in field.

2.10 AUTOMATIC ALARM INITIATING DEVICES

.1 Addressable variable-sensitivity fire detectors:
  .1 Combination Photoelectric and fixed heat type.
  .2 Electronics to communicate detector's status to addressable module.
  .3 Detector address to be set on detector base in field.
  .4 Sensitivity settings: Five (5) settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.
  .5 Ability to annunciate levels of detector contamination automatically with trouble condition at control panel.
  .6 Where detectors are concealed supply and install a remote mounted LED indicator at a visible location.
.2 Addressable duct smoke detector:
  .1 Photoelectric type.
  .2 Electronics to communicate detector's status to addressable module.
  .3 Detector address to be set on detector base in field.
  .4 Twistlock plug-in type with fixed base.
  .5 Air duct type with sampling tubes with protective housing.
  .6 Assembly with integral red alarm LED and terminals for remote relay alarm LED.
  .7 Where smoke detectors are concealed provide remote mounted LED indicators at visible location.
  .8 Activation of duct detectors to cause shutdown of associated air handling unit.

2.11 ADDRESSABLE INTERFACE MODULES

.1 Interface modules: facilitate connection of non-addressable devices (e.g. flow switch) to control panel; provided in different types for connection to monitoring devices (e.g. flow/tamper switch) and control functions (e.g. fan shutdown, door release); communicate

with control panel over (minimum number of wires) or (specified by manufacturer) or (addressable devices loop).

2.12 AUDIBLE SIGNAL DEVICES

.1 Horns: electronic with backbox, 92dB, surface flush mounting 24 VDC.
.2 Combination with strobe as indicated.
.3 Do not exceed 80% of listed rating in amperes of notification appliance circuit. Provide additional circuits above those shown in required to meet this requirement.
.4 Output to be synchronized with all other notification devices on the notification circuit and all notification devices located in an observer's audible and visible range.
.5 Audible signal type in Holland College Greenbuild Campus to match existing audible signal type in existing Building.
.6 Finish appliances in red.

2.13 VISUAL ALARM SIGNAL DEVICES

.1 Strobe type: 30 candela, self-synchronizing, 24 VDC, red in colour.
.2 Polycarbonate lens with FIRE/FEU imprinted on device.
.3 Designed for surface mounting on flush outlet box.
.4 For surface mounting provide appliance manufacturer's approved back box. Back box finish to match appliance finish.

2.14 FAULT ISOLATORS

.1 Provide line fault isolators in detector bases or separately mounted. The isolator relay is controlled by the detector or the loop controller.
.2 The isolator operates as follows:
    .1 A short on the line causes all isolators to open within 23 msec.
    .2 At 10 msec intervals, beginning nearest the loop controller, the isolators close to provide the next isolator down the line with power.
    .3 When the isolator next to the short closes, it reopens within 10 msec.

2.15 END OF LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signaling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.16 PASSIVE GRAPHIC DISPLAY

.1 Passive graphic displays on white photo bond paper in metal frame with polycarbonate or plexiglass glazing.
.2 All existing graphic displays that have been modified by the renovations are to be updated and then securely attached to the wall adjacent to the fire alarm panel and remote annunciators so as to limit the possibility of loss or damage. The labelling on the graphic must closely correspond to the displays on the fire alarm annunciator or the labels for each alarm indication. All wording shall be in both English and French. The floor plan drawing is to indicate:
    .1 The building outline showing all exterior doors.
    .2 The building's room divisions, corridors, stairways and elevator.
    .3 The location of, and divisions between, the fire alarm zones.
    .4 The location of the main fire alarm control panel.
    .5 The location of the main valve for the sprinkler system and the valve for each zone as well as any other supervised valve. Use of a legend and symbols is recommended.
    .6 The smoke detector locations in ventilation equipment rooms. Use of a legend and symbols is recommended.

.7 An accurate "You are here" indicator. Graphic display must be oriented to match the direction of the location at which it is to be posted, i.e. oriented to the direction in which the person viewing the display is facing.

.3 Electronic floor plans of the areas modified by the renovations may be obtained for production of the fire alarm graphic from the Engineer-Architect for $200.00 per drawing plus HST.

2.17 MANUFACTURER

.1 Acceptable material to match existing:

.1 Siemens.

3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524.

.2 For signal, alarm and ancillary devices, wire in EMT conduit with wire counts to be approved by fire alarm equipment manufacturer prior to installation. Install alarm and signal circuits in separate conduits. Surface mounted devices to be installed on matching outlet boxes recommended by manufacturer.

.3 Install control panel at 60" AFF to center and connect to AC power supply.

.4 Install addressable loops.

.5 Surface mounted fire alarm conduit or boxes located in finished areas to be painted to match the associated surface color. Coordinate exact color(s) on-site.

.6 Locate and install manual alarm stations as indicated and connect to initiation circuit loops.

.7 Locate and install detectors as indicated and connect to initiation circuit loops. Do not mount detectors in direct airflow from supply or exhaust air outlets. Maintain at least 18" radius clear space on ceiling, below and around detectors in accordance with CAN/ULC-554.

.8 Connect sprinkler system alarm and supervisory switches using addressable interface modules.

.9 Provide for fan shut down, door release, etc. using relays and intelligent interface modules.

.10 Confirm with manufacturer if supplied interface modules require separate DC power and if so, install DC power to interface module from control panel in accordance with manufacturers wiring instructions.

.11 Install signal devices as indicated and connect to signaling circuit.

.12 Install end-of-line devices as required.

.13 Coordinate with the Owner and manufacturer for the naming of all loop device locations. Provide a list to the Owner indicating all proposed naming prior to programming. Make changes as directed by Owner at no extra charge. Arrange with the manufacturer to have location names listed on charts with loop numbers and device addresses. During installation of devices, peel the serial number label from the device and stick to the location message chart beside the location name.

.14 Include system configuration and programming to meet the needs of the new and existing building designs as required. Include programming of detection devices, relays, signal devices and custom configuration.

.15 Connect fire alarm system to remote monitoring station. On behalf of the Owner, make all arrangements for 24-hour remote monitoring at location of Owner's choice and verify that alarm signals are received. Include for one (1) year of monitoring service in total tender price.

3.2 FIELD QUALITY CONTROL

.1 Site Tests:

.1 Conduct tests to Section 26 05 00 - Common Work Results - Electrical and CAN/ULC-S537 for system modifications.

.2 Test each device and alarm circuit to ensure manual stations, smoke detectors and sprinkler system input signals transmit alarm to control panel and actuate general, first stage alarm and ancillary devices.

.3 Verify fan control or shutdown.
.4 Where applicable check annunciator panels to ensure zones are shown correctly.
.5 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of trouble signals.
.6 Addressable circuits system:
.1 Test each conductor.
.2 Check to ensure zones are shown correctly.
.3 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of trouble signals.
.4 Verify trouble and alarm signals are received at the remote supervised location via both non-interdependent communication channels in accordance with CAN/ULC-S561.

.2 Manufacturers Field Service:
.1 Obtain written report from manufacturer verifying compliance of work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports in accordance with this Section and the Contract Documents.
.2 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 Schedule site visits to review work in accordance with this Section and the Contract Documents.

.3 Certificates and Reports:
.1 Provide:
.1 A copy of the inspecting technician's report showing location of each device and certifying the test results of each device.
.2 A certificate of verification confirming that the inspection has been completed in accordance with CAN/ULC-S537 and CAN/ULC-S561, and showing the conditions upon which such inspection and certification have been rendered.
.3 Final test and acceptance of the system shall be witnessed by representatives of three parties: the Owner, the Contractor and the manufacturer.

3.3 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and installation for water mains, hydrants, valves, valve boxes, and valve chambers, including service connections.

1.2 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
- .1 ANSI/AWWA A100-(90), Water Wells
- .2 ANSI/AWWA C200-97, Steel Water Pipe - 6 in (150 mm) and Larger.
- .3 ANSI/AWWA C206-97, Field Welding of Steel Water Pipe.
- .4 ANSI/AWWA C208-01, Dimensions for Fabricated Steel Water Pipe Fittings.
- .5 ANSI/AWWA C654-99, Disinfecting Water Mains.
- .6 ANSI/AWWA C800-01, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).

.2 American Society for Testing and Materials International, (ASTM)
- .1 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
- .2 ASTM A307-02, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.3 American Water Works Association (AWWA)/Manual of Practice
- .1 AWWA M11-1989, Steel Pipe - A Guide for Design and Installation.

1.3 SUBMITTALS

.1 Submit shop drawings in accordance with Division 01 - General Requirements.

.2 Submit copy of Groundwater Exploration permit and Ground Water Extraction permit as required by the Department of Land and Environment, prior to drilling.

1.4 CLOSEOUT SUBMITTALS

.1 Provide data to produce record drawings, list of equipment, details of pipe material, location of air and vacuum release valves, maintenance and operating instructions in accordance with Division 01 - General Requirements.
- .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, and valve chambers.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Separate for reuse and place in designated containers Steel waste in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 Ensure emptied containers are sealed and stored safely.

.7 Divert unused metal materials from landfill to metal recycling facility.

.8 Dispose of unused disinfection material at official hazardous material collections site.

.9 Do not dispose of unused disinfection material into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.

.10 Fold up metal banding, flatten and place in designated area for recycling.

1.6 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.
.2 Submit schedule of expected interruptions to Consultant for approval and adhere to interruption schedule as approved by Consultant.
.3 Notify Consultant minimum of 72 h in advance of interruption in service.

1.7 REPORTS

.1 On completion of work, submit to Engineer report containing:
  .1 Log of well drilling.
  .2 Geophysical logs.
  .3 Record drawing of well including:
    .1 Elevations.
    .2 Size and length of each casing section installed.
    .3 Grouting details
  .4 Records of all static water level measurements times at which they were taken and any observable changes in static water level with well depth.
  .5 Results of interim and final pumping tests.
  .6 Well development data.
  .7 Results of testing of water sample for suspended solids, chemical and bacteriological content.

2 Products

2.1 GENERAL

.1 Provide two (2) 6" diameter supply wells and one (1) 6" diameter injection (return) wells as shown on the Drawings, in accordance with all Local Authorities Having Jurisdiction, with each supply well capable of supplying 62 US GPM.
.2 Provide supply and return wells at approximately 150 ft and cased to a depth of 80ft.
.3 Contractor shall submit cost per foot for additions or deletions for both the well drilling and well casing on the Bid Form.
.4 Provide all permits, certifications and conform to all regulations in providing the required wells.

2.2 PERMANENT WELL CASING

.1 10" casing to ANSI/AWWA, C200 ASTM, A 53, ASTM F480.
.2 Use pipe fittings of same standard as pipe casing.
.3 Joints: welded or threaded couplings.
.4 PVC or ABS pipe to be manufactured from virgin resin.

3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.
  .1 Inspect materials for defects to approval of Consultant.
  .2 Remove defective materials from site as directed by Consultant.

3.2 DRILLING

.1 Drill holes plumb and straight.
.2 Ensure drilling methods do not impair production from aquifers encountered.
.3 Prevent foreign matter from entering bore hole and prevent contaminated water or other objectionable fluids from reaching aquifer through bore hole.
.4 Cover top of bore hole to prevent tampering and eliminate dangerous conditions for persons or animals in area.

.5 Maintain log of all bore holes including following information:
  .1 Depth of changes in formation.
  .2 Description of formations encountered.
  .3 Elevations at which aquifers are encountered, sudden changes in water level, loss of drilling fluid or other indications of permeable strata.
.6 In unconsolidated formations, obtain duplicate soil samples from each 10" of depth drilled and at least one set of duplicate samples from each formation encountered. Submit samples to Engineer with identification data on drill hole and depth.
.7 Obtain continuous samples for at least 25' through aquifer to be screened using split spoon sampling or other method approved by Engineer.
.8 In consolidated formation, obtain one rock sample from each 20' of depth drilled.
.9 Conduct well development and pumping tests, and obtain clear water samples as directed by Engineer.
.10 Be prepared to control, shut off and/or seal hole should flowing artesian water or gas be encountered.
.11 Equip arterial wells with variable flow control device to control rate of flow after completion. Stop flow of water for period of not less than 48 h by closing control device, and determine if well is effectively sealed to prevent escape of water from annular space of well and its immediate vicinity. Seal off water by grouting as necessary.
.12 Seal abandoned holes by approved methods with concrete, cement bentonite grout, other material approved by Engineer.
.13 Re-drill holes lost due to caving or abandoned due to loss of drilling equipment at no cost.

3.3 PERMANENT CASING INSTALLATION

.1 Clean casing pipe and fittings prior to installation.
.2 Install permanent well casing to sizes and depths as suited to formation(s) encountered.
.3 Protect PVC or ABS pipe casing against damage by enclosing upper within steel casing.
.4 Center casing by use of centering brackets and install so that variance from vertical does not exceed two thirds internal diameter of casing per 100' of depth.
.5 Seal annular space between casing and borehole wall by grouting, to prevent entrance of surface water or other deleterious matter into aquifer, and to prevent intermixing of water.
.6 After grouting is completed, cut off casing squarely and neatly, maximum 18" above ground level and minimum 2' above highest recorded flood level.
.7 Maintain accurate records of casing lengths and sizes installed.

3.4 DISINFECTION

.1 After well has been completely constructed, thoroughly clean of foreign substances, including tools, timbers, rope, cement, oil, grease, joint dope and scum. Thoroughly swab casing pipe using alkalis if necessary to remove oil, grease or joint dope.
.2 Disinfect well in accordance with ANSI/AWWA C654.

3.5 TEST PUMPING

.1 Equipment requirements:
  .1 Pump with variable pumping rate up to a capacity of at least 62 GPM and capable of operating a minimum of 12 hours, without interruption.
  .2 Step draw down pump test shall be completed on each supply and return well in accordance with regulations. Step rates shall be 20, 40 and 62 GPM.
  .3 A twelve (12) hour constant rate pump test shall be completed on each supply and return well. Recovery measurements shall be completed for three (3) hours after the test is completed.
  .4 Return wells shall be used for disposing water during the step and constant rate pump tests. Each well designated a return well shall have water levels measured and recorded during injection tests.

.5 Discharge piping of sufficient size and length to conduct water being pumped during test to an approved point of discharge where it will not recharge aquifer, damage property or create nuisance and equipped with valve close to pump.

.6 Apparatus to measure rate of pump discharge shall be an orifice plate with transparent tube to measure water head upstream of plate, or suitable water meter.

.7 Apparatus to measure pumping level shall be an electric sounder or calibrated air line.

.8 Test shall be performed in accordance with all local regulations and guidelines of the authority having jurisdiction.

.9 Provide test report to engineer for final pump sizing.

END OF SECTION

APPENDIX 'A'
Data Wiring Guidelines

DATA WIRING GUIDELINES - Holland College

March 9, 2020

SUMMARY:

- All cable and equipment must be of high quality and from well-respected manufacturers such as Belden, Panduit, etc. ..
- Cables, Patch Panels, and Modular Jacks - all must be installed as per Category 6 specifications – which includes the routing, termination and support of the cable runs …
- Especially in recently renovated locations, all cable runs (single or multiple runs) must be bundled and routed in an organized fashion – as per the details below (must follow existing cable trays, conduit, etc. – not just run diagonally on top of ceiling tile)
- cables, patch panels, etc. must be clearly labeled **as defined by Holland College technical staff** (in accordance with any existing labeling).
- The various categories of use must be terminated and labeled in their own "area" of the data rack (i.e. Data, Voice, IP Cameras, Lockdown, Building Systems, etc.) – according to the syntax provided by Integrated Technology Services. We want to be able to easily identify these separate categories on a patch panel(s).
- ***Vendor must provide Holland College with electronic printout of scanner results*** – email itservices@hollandcollege.com

DETAILS:

1. **Cable Supports, Harnesses and Sleeves**
    a. All free-running cables shall be securely fastened to appropriate cable supports and harnesses so that cables are routed tightly to ensure a maximum interharness cable sag of 150mm.
    b. All cables shall be completely supported by the harnesses so that the entire mass of the cables and harnesses is self-supporting and no weight is transferred to any other existing fixture or structure in the ceiling space (i.e. suspended ceiling or light fixtures).
    c. Cable supports and harnesses must not be welded to structural steel members and burning of holes in structural steel is prohibited.
2. **Cabling Specifications**
    a. Data and Voice cables UTP:
        i. The unshielded twisted pair data cables shall be Category 6 (24 AWG – high performance EIA/TIA 568B 2.1 specifications – Belden Gigaflex 2400 or equivalent).
3. **Cabling System Certification**
    a. All cables must be installed in accordance with the manufacturer's requirements for system certification.

b. All supplied products must be compatible with each other when connected for compliance to **both EIA/TIA Category 6 Permanent Link and Channel Test Performance Specifications**. (total installation must be within acceptable limits). http://www.siemon.com/us/standards/6limits.asp

c. Installer must provide Holland College with electronic copies of the scanner printouts verifying that the data lines installed are in compliance with both EIA/TIA Category 6 Permanent Link and Channel Test Performance Specifications. This must be emailed to Integrated Technology Services Dept. at Holland College before invoice will be paid. (itservices@hollandcollege.com)

4. Cable installation

a. All cables to be pulled in a continuous run – no splicing is permitted
b. All cables shall be neatly bundled and tie-wrapped. Route cables on cable tray (where one exists) through the corridor ceiling space.
    i. Velcro tie wraps must be used for cable bundling and routing. Standard plastic tie-wraps are unacceptable.
    ii. Velcro tie wraps are to be installed at a minimum of every 8" where cables are exposed within the Termination Rooms (wiring closets).
c. Utilize all available cable pathways such as conduit, cable trays, ducts, raceways and furniture channels, except where otherwise advised by Holland College. Exercise caution when pulling cables in such pathways as to avoid damage to any existing cabling and to ensure that the manufacturer's maximum pull-force and minimum bend-radii specifications are adhered to.
d. Any ceiling routed free-running cables shall be securely fastened to appropriate cable supports and harnesses a minimum of every (6) feet so that cables are routed tightly to the underslab above (not just laying on a dropped ceiling).
    i. Unless otherwise approved by IT Services at Holland College, the contractor shall route all free-running cables in "main common-bundled routes through the facility to the termination locations. **DIAGONAL cable runs will not be accepted** (this is especially true in the newer locations where cables all run from a room to a central corridor, and then to the wiring closet).
e. Route all cables and conduits to ensure adequate separation from sources of interference such as lighting, power cables, HVAC and electrical equipment.
f. When routing horizontal distribution cables to termination panels, all cables must be organized to minimize cross-overs and congestion
g. Cable labels must be installed **at the time of outlet termination** and should be **mechanically printed** in a clear and professional manner on self-laminating vinyl labels.
h. **Cable labels must adhere to the syntax defined by the Integrated Technology Systems Department** and (unless otherwise instructed), should identify the **Closet (letter)** – **Patch Panel (letter)** -and the **Patch Panel Port (number)**. (i.e. **F-B-17**)

5. **Patch Panel and Modular Jacks**
    a. Patch panels must be 19" rack mountable, 2U high, 48-port modular jack panels - Belden # AX101458 or equivalent from an industry leading manufacturer (i.e. Panduit, etc.).
        i. All ports must be DISCRETE and individually replaceable. Multi-port ganged modules are not acceptable.
    b. Data patch panel modular jacks shall:
        i. Be Belden Gigaflex PS6+ - AX101071 or equivalent (from an industry leading manufacturer such as Panduit, etc.)
        ii. Be (8) position jacks with insulation displacement contacts for cable terminations.
        iii. Utilize the T568A pinout connector scheme and be appropriately color coded.
        iv. Meet a minimum of EIA/TIA Category 6 hardware specifications
        v. Have a minimum of 50 microns of gold plating over a nickel base, be UL listed, CSA approved, and shall meet FCC part 68 requirements.
    c. At all cabling termination points, the individual cable pairs must maintain their twists to the point of termination onto the modular jack or connector.
        i. A maximum amount of (0.25 inches) of cable can be untwisted at the termination point for all cables.
        ii. A maximum amount of (1.0 inches) of outer cable sheath can be removed at all termination locations.
    d. All patch panel installations should include horizontal cable management
    e. Data, Voice, IP Cameras, Building Systems, and Lockdown cables **must be terminated in separate (and clearly labeled) patch panels** – unless otherwise approved by Integrated Technology Services at Holland College. In smaller locations, it may be acceptable to segregate a 48-port patch panel into separate sections for each of the categories above – as long as there is some room for additional expansion in that same area.
        i. In the end, we want all data drops terminated in one location of the rack, voice drops in another, IP cameras in their own section, etc. etc. .. We don't want them all intermixed …
    f. All patch panels and modular jacks shall be labeled in a clear and professional manner – using mechanically printed adhesive vinyl labels.

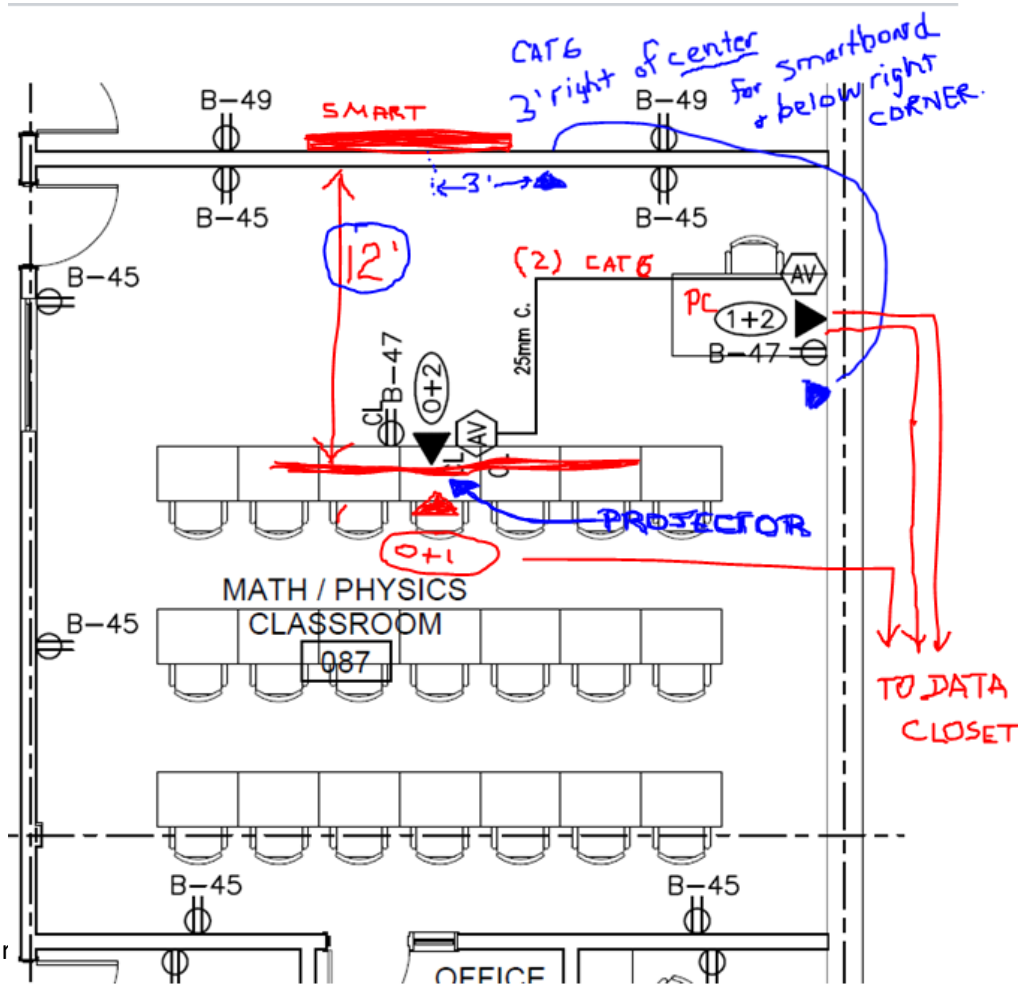
AUDIO VISUAL INSTALLATIONS:

For each mounted projector and smart board installation, you generally require:

- A PC located near the front of the room with:
    - (2) CAT6 data drops going to the wiring closet
    - (2) CAT6 data drops going to the mounted projector in the ceiling (which is approximately 12' back from the screen)
    - (1) CAT6 data drop going to the lower right corner of the smart board (if present)
    - Electrical outlets for the PC, Display, CAT6 converter, and possibly an audio amplifier

- A projector mounted in the ceiling with:
    - (1) CAT6 data drop going back to the wiring closet
    - (2) CAT6 data drops going to the projector PC (as described above)
    - Electrical outlets for the projector and CAT6 converter
    - If ceiling speakers and an audio amplifier are included, you may also need :
        - Electrical outlet for an audio amplifier
        - Shelving for audio amplifier
        - Speaker wire and speakers installed in ceiling
        - **NOTE:** Contractor must take into account any sprinklers, ductwork, light fixtures, etc., in the ceiling which may prevent easy data/electrical connection to the ceiling-mounted projector. The patch cables and powercords from the projector will typically only reach about 2 feet from where the projector mount enters the ceiling tile. **The contractor installed data/electrical must be within easy reach of the projector.**

In the diagram below, you can see a typical classroom layout with the desk, ceiling mounted projector, and smart board.



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SCHEDULES

- Material / Finish Schedule
- Accessories Schedule

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Holland College Summerside Waterfront Campus Greenbuild Trade Centre
Coles Associates Ltd. – 261102
Material / Finish Schedule
Date / Issue: Oct 29, 2026 - Issued for Tender
Revision: R0 (Note: Items underlined have been revised)
Notes: Refer to the end of this schedule.

TAG	TYPE	MANUFACTURER / SUPPLIER (Standard of acceptance)	DESCRIPTION / FINISH / TEXTURE	COLOUR	LOCATION	COMMENTS
Acoustic Ceilings						
ACT-1	Ceiling Tile	Armstrong	Product: Fine Fissured Texture: Medium Square Lay-In Size: 610 x 1220 x 16, Item 1729 NRC 0.55, CAC 33 Fire Performance: Class A	White	110 Virtual Firing Range	
n/a	Suspension System	Armstrong	Prelude XL 24mm / 15/16"	White	Use with all ACT	
Aluminum						
AL-1	Aluminum	See Spec		Gray	Exterior Windows/Storefronts	
Concrete						
CO-1	Poured in place	See Spec		with clear sealer		
Corner Guards						
CG-1	Stainless Steel	See Spec		Stainles Steel		Installed on all outside wall corners
Grout						
G-1	Grout	MAPEI	Ultracolor Plus FA Consultant to select grout widths	Select from standard range colour may vary for different tile types	All Grout	
Glazing						
GL-1	Tempered Laminated Glass		6mm Thick Smooth	Clear	Provide in interior windows	
GL-2	Ceramic Safety Glass	FireLite	5mm Thick Smooth	Clear / Wireless	Provide at all interior windows located in 1 hr fire-rated walls	Glazing, frame, stops, gaskets, and sealants to be a listed 45 min fire-rated assembly.
GL-3	Insulated Glazing			Light Gray	All exterior glazing	
Pre-Finished Metal						
MT-1	Insulated Metal Panel	See Spec	Smooth	Mushroom	Exterior siding	
Paint						
P-1	Paint	Benjamin Moore	Confirm sheen with consultant	Chantilly Lace 2121-70	Primary paint	
P-2	Paint	Benjamin Moore	Confirm sheen with consultant	Wickham Gray HC-171	Door frames and doors	
P-3	Paint	Benjamin Moore	Confirm sheen with consultant	Chantilly Lace 2121-70	Ceilings	
Resilient Base						
RB-1	Resilient Base	Johnsonite	Height: 102mm with Toe, Vinyl	Medium Grey #28	Refer to room finish schedule	
Tile						

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TAG	TYPE	MANUFACTURER / SUPPLIER (Standard of acceptance)	DESCRIPTION / FINISH / TEXTURE	COLOUR	LOCATION	COMMENTS
T-1	Porcelain Tile	Centura	Collection: Glocal Size: 305 x 610 Pattern: running bond Finish: Matte	Grey, Glocal Ideal Natural	Refer to floor finish plans for all locations	Provide 100mm high tile base to match floor tile
T-2	Ceramic Tile	Olympia Tile	Collection: Colour & Dimensions Size: 100 x 300 Pattern: stack bond, horizontal Finish: Matte, Glazed Ceramic	Warm White	Washroom wall tile	1500 high
Transition strips						
TS-1	Resilient Transition Strip	Johnsonite	Consultant to select colour and profile from standard range		Resilient flooring to other floor materials	
Tile Trim						
TT-1	Tile Trim	Schluter Systems	Consultant to select profile from standard range	Clear anodized aluminum	Tile to GWB locations and Tile to other floor materials	
Wood						
WD-1	Wood	Baillargeon	Rotary Cut Veneer Factory finished	White Birch Clear	Interior doors	
WD-2	Wood	See Spec	Stained wood veneer panels and trim, smooth vertical grain, satin clear coat	Match to existing entrances	Main Entrance (from hallway)	

Notes:
1. Contractor is to confirm that all product names and numbers correspond. If a discrepancy is found, the consultant is to be notified immediately for clarification.
2. The general location of materials is noted for convenience, refer to drawings for all tagged locations.

AD010

Holland College Summerside Waterfront Campus Greenbuild Trade Centre
Coles Associates Ltd. – 261102

Accessories Schedule

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TAG	TYPE	MANUFACTURER / SUPPLIER (Standard of acceptance)	DESCRIPTION	COLOUR	FINISH / TEXTURE	LOCATION	COMMENTS
Toilet Accessories							
CH	COAT HOOK	Bobrick	B-212 Coat hook with bumper solid cast aluminum		matte	Washroom, mount on inside of door	Contractor supply & install
GB1	GRAB BAR	Bobrick	B-5898.99 762mm x 762mm 32mm Diameter 90 Grab Bar, Peened 18ga, stainless steel tubing Concealed mounting flange		304 satin finish peened	Washroom Adjacent wall at barrier free toilets	Contractor supply & install
GB2	GRAB BAR	Bobrick	B-5806.99 x 610mm 32mm Diameter Straight Grab Bar, Peened 18ga, stainless steel tubing Concealed mounting flange		304 satin finish peened	Washroom Behind barrier free toilets (horizontal)	Contractor supply & install
MIR	MIRROR	Bobrick	B-290 Series One-piece, roll-fromed 19x19 angle frame Type 304 Stainless steel angle with satin finish No 1 quality, 6mm glass mirror Size: 610w x 915h		satin stainless steel	Washroom (1) each	Contractor supply & install
ND	NAPKIN DISPOSAL	Bobrick	B-270 Surface-Mounted Sanitary Napkin Disposal Size: 190w x 255h x 95d		satin stainless steel	105 Washroom (1) each	Contractor supply & install
PTD	PAPER TOWEL DISPENSER	Bobrick	B-72860 Surface Mounted Touch free pull towel mechanism Size: 320w x 395h x 240d accommodates 205w x up to 205 dia rolls		high-impact resin, door is translucent dark grey	Washroom (1) at each sink	Owner supply &Contractor install
SD	SOAP DISPENSER	Bobrick	B-2111 Series: Classic Series Surface Mounted Soap Dispenser Concealed wall fastening Size: 120w x 205h x 90d		satin stainless steel	Washroom (1) at each sink	Owner supply &Contractor install
SH	SHELF	Bobrick	B-295 Stainless Steel Shelf Size: 405w x 75h x 125d 18Ga Type 304 stainless steel		satin stainless steel	Washroom (1) at each sink	Contractor supply & install

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TPD	TOILET PAPER DISPENSER	Bobrick	B-2840 Toilet Tissue Dispenser with Utility Shelf Size: 405w x 100h x 125d Holds (2) rolls up to 140 dia		satin stainless steel	Washroom (1) at each toilet	Owner supply &Contractor install
WR	WASTE RECEPTACLE	Bobrick	B-2260 Finish: Satin Stainless Steel Floor Standing, Open Top Size: 340w × 553h × 340d mm		satin stainless steel	Washroom (1) each	Contractor supply & install

Notes:
1. Contractor is to confirm that all product names and numbers correspond. If a discrepancy is found, the consultant is to be notified immediately for clarification.