

CRA2026-T-006

25-063

Western Financial Place - Evaporative Condenser

1777 2 St. N, Cranbrook, BC

City of Cranbrook

Western Financial Place - Evaporative Condenser Replacement

Issued for Tender

2026 10 05



berry architecture
+associates

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SECTION 00 01 07
SEALS PAGE

Part 1 General

1.1 ARCHITECTURAL STAMP

.1



2026-10-05

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 00 01 15
LIST OF DRAWING SHEETS

Part 1 General

1.1 DRAWING LIST

.1 ARCHITECTURAL
A0.0 TITLE PAGE
A2.0 SITE PLAN

MECHANICAL
M0 TITLE PAGE
M1 P&ID - DEMOLITION
M2 P&ID - NEW
M3 DETAILS AND SCHEDULES

END OF SECTION

SECTION 00 21 13 INSTRUCTIONS TO BIDDERS

Part 1 General

1.1 SCOPE OF WORK

- .1 The scope of work includes replacing the Evaporative Condenser at Western Financial Place, located at 1777 2 St N, Cranbrook, BC. Refer to Schedule A for the full Mechanical Specification.
- .2 On site work to occur in June, 2027 as the facility will be shut down for two weeks for annual maintenance.

1.2 BID CALL

- .1 Bids will be received before 2:00:01 pm local time on October 27, 2026 (the "bid closing time") at:

City of Cranbrook
 - submission through BC Bids.
- .2 The official bid closing time will be determined by the email time stamp at the bid closing location.
- .3 Bids received after the specified bid closing time will be returned unopened.
- .4 The Owner reserves the right to extend the bid closing time or cancel the bid call by addendum.
- .5 Bids will not be opened publicly.
- .6 Bid results will be disclosed to all Bidders. Such disclosure will not imply that the bids received are compliant or that a contract will be awarded to the lowest or any Bidder.

1.3 BID DOCUMENT AVAILABILITY

- .1 Bid Documents are made available in electronic form only for the purpose of obtaining bids for this project. It does not confer a license to use the Bid Documents for any other purpose.
- .2 Electronic copy Bid Documents may be accessed at BC Bids.

1.4 EXAMINATION OF BID DOCUMENTS

- .1 Examine the Bid Documents and promptly notify the person designated to receive inquiries of any perceived errors, omissions, conflicts or discrepancies in the Bid Documents.

1.5 PRE-BID MEETING AND SITE VISIT

- .1 A pre-bid meeting and site visit at the Place of the Work has been scheduled for 10:00 a.m. local time on October 13, 2026. Attendees shall meet at main entrance.
- .2 All prime contract Bidders attendance are invited to attend but attendance is not mandatory.
- .3 All major subcontract Bidders are invited to attend but attendance is not mandatory.
- .4 Issues arising from the pre-bid meeting and site visit will be addressed as required in an addendum to the Bid Documents. No meeting minutes will be issued. Bidders may not rely upon any information given verbally or otherwise at the pre-bid meeting and site visit and that is not confirmed by addendum.

1.6 BID MATRIX

- .1 The Owner will evaluate the Bids according to the following matrix. Bids will be evaluated and short-listed or rejected based on the requirements based on the following selection criteria.

- .1 Bid Price: 70 points.
 - .1 (Lowest Price/Your Company Price)*70
- .2 Experience and Team: 10 points.
 - .1 Provide information to explain company's experience with similar projects, and the team assigned to the project.
- .3 Schedule: 10 points.
 - .1 Provide a detailed construction schedule to complete the project.
- .4 Methodology to complete the work: 10 points.
 - .1 Provide a work plan to complete the project.

1.7 BID FORM SUPPLEMENTS

- .1 Submit the following Bid Form Supplements together with the Bid Form:
 - .1 Bid security as specified, including Bid Bond and Consent of Surety.
 - .2 Section 00 43 36 – Bid Form Supplement - List of Subcontractors. (within 2 hours of Bid Closing)
 - .3 Bid Security - See below article.
 - .4 Section 00 73 63 - Contract Security Requirements (Consent of Surety).
 - .5 WorkSafe BC, and Insurance Certificate, documentation.
 - .6 Bid Matrix items identified above.
- .2 The Owner may, after the bid closing time and before contract award, require any Bidder to submit additional supplementary information about any aspect of the Bidder's bid to verify compliance with the Bid Documents.

1.8 BID SECURITY

- .1 Submit with the bid a CCDC 220 form of bid bond in an amount of not less than 10% of the bid price.
- .2 The bid bond shall name the Owner as the obligee and shall be signed, sealed, and dated by both Bidder and surety.
- .3 Upon request, bid bonds of unsuccessful Bidders will be returned after the successful Bidder has entered into a contract with the Owner and provided the specified contract security, or earlier at the Owner's discretion.
- .4 In lieu of a bid bond, Bidders may submit a certified cheque or bank draft in an amount of not less than 10% of the bid price.

1.9 BIDDER DEFAULT AND FORFEITURE OF BID SECURITY

- .1 If a Bidder whose bid is accepted by the Owner in writing, without conditions, and within the acceptance period specified in the Bid Documents, refuses or fails within 15 calendar days after the date of issuance of the written acceptance of the bid, to sign a formal agreement with the Owner for the performance of the Work and to provide contract performance security as specified in the Bid Documents, the Bidder will be liable to the Owner for the difference in money between the Bidder's bid price and the amount for which the Owner legally contracts with another party to perform the Work, if the latter amount is in excess of the former, up to the maximum amount of the bid security provided.

1.10 CONTRACT SECURITY

- .1 Refer to Section 00 73 63 – Contract Security Requirements.

1.11 TAXES

- .1 Include in bid price all taxes and customs duties in effect at the time of the bid closing, except for Value Added Taxes as defined in the CCDC standard form of contract.

1.12 CONTRACT TIME

- .1 The Bidder, in submitting a bid, agrees to attain Substantial Performance of the Work by the date specified in the Bid Form, which will become the Contract Time under the Contract.

1.13 SUBSTITUTIONS

- .1 Where the Bid Documents specify particular Products by proprietary name, Bidders shall base their bids on the named Products only. The Consultant will not consider requests for approval of substitutions during the bid period. Refer to Section 01 25 00 – Substitution Procedures for substitutions after contract award.

1.14 LIST OF SUBCONTRACTORS

- .1 Complete and submit Section 00 43 36 – Bid Form Supplement – List of Subcontractors, indicating those Subcontractors or Suppliers whose bids have been received by the Bidder, which names the Bidder would be prepared to accept for the performance of the work indicated.
- .2 The purpose of this requirement is to protect the interests of subcontract bidders and the integrity of the bidding process. Provided the List of Subcontractors has been properly completed and submitted, the information will not be used in evaluating the Bids to determine the lowest compliant bidder.

1.15 BID FORM SIGNING

- .1 Complete the Bid Form as follows:
 - .1 Incorporated Company: Provide company name and name and signature of the duly authorized signing representative(s). Insert under each signature the representative's capacity to act on behalf of the company.
 - .2 Joint Venture: Each entity within the joint venture shall execute the Bid Form as specified.
 - .3 Partnership: Provide name of partnership and name and signature of duly authorized representatives of the partnership.
 - .4 Sole Proprietorship: Provide name of sole proprietorship and name and signature of sole proprietor in the presence of a witness who shall also sign.

1.16 BID SUBMISSION

- .1 Complete Bid Form, in its entirety, on the form provided and submit together with the required Bid Form Supplements, completed in their entirety, in a sealed opaque envelope, clearly identified on the outside with the following information:
 - .1 Name and address of Procurement Authority.
 - .2 Bidder's name and address.
 - .3 Project name.
- .2 Bids will be received in electronic form only. Submit bid in compliance with the electronic bid submission procedures established by Owner.
- .3 Verbal, telephoned, fax, or text message bids will not be accepted nor acknowledged.

1.17 BID MODIFICATION AND WITHDRAWAL

- .1 For bid closing time purposes, the official time of receipt of emailed bid modifications or withdrawal requests will be the time of receipt automatically printed on the email.

- .2 If a bid is withdrawn, a new bid may be submitted in accordance with the specified requirements, provided it is received before the bid closing time.
- .3 When submitting a modification directing a change in a bid price, do not reveal the original amount nor the revised amount:
 - .1 on stipulated price bids, state only the amount to be added to or deducted from the original bid price.
- .4 When submitting a second or more modifications related to a particular bid price, ensure that there is no ambiguity as to the intended bid price. The written modification shall clearly indicate whether:
 - .1 the bid price first submitted is being modified and any previous modifications are to be disregarded, or
 - .2 a revised bid price derived from a previous modification is being modified.
- .5 State all addendum numbers received, if different from what was indicated on originally submitted Bid Form.
- .6 The Owner will assume no responsibility or liability for modifications or withdrawals that are, for any reason, delayed, illegible, unclear as to intent, ambiguous, contrary to these instructions, or otherwise improperly received. The Owner may disregard improperly received modifications or withdrawals.

1.18 BIDDING IRREGULARITIES

- .1 Bids with Bid Forms or required Bid Form Supplements that are improperly prepared, signed or submitted contrary to these Instructions to Bidders, or that contain added conditions or other irregularities of any kind, may, at the Owner's discretion, be rejected as non-compliant.
- .2 The Owner may accept or waive a minor and inconsequential irregularity. The determination of what is, or is not, a minor and inconsequential irregularity, the determination of whether or not to accept or waive such an irregularity, and the final determination of whether the bid is compliant, will be at the Owner's sole discretion.
- .3 The following irregularities relate to what are considered mandatory bidding requirements. These will not be considered minor and inconsequential and will cause the bid to be rejected as non-compliant:
 - .1 Bid or Bid Form Supplement is received after the specified bid closing time.
 - .2 Required Bid Form or Bid Form Supplement is missing.
 - .3 Bid Form or Bid Form Supplement is not in the form provided or required.
 - .4 Bid bond is improperly completed or executed, if such improper completion or execution may render the bid bond unenforceable.
 - .5 A bid price is illegible, ambiguous or unclear.
 - .6 One or more conditions are added to or submitted with the bid, the effect of which is a material modification of the Bid Documents.
 - .7 Failure to indicate in the Bid Form the addendum number(s) of all addenda received.
 - .8 Failure to comply with any other bidding requirement expressly characterized as mandatory in elsewhere in the Bid Documents.

1.19 BID ACCEPTANCE PERIOD

- .1 Bids shall remain open to acceptance by the Owner and shall be irrevocable until another Bidder enters into a contract with the Owner for performance of the Work or until expiry of the bid acceptance period stated in the Bid Form, whichever occurs first.
- .2 After bid closing and before expiry of the bid acceptance period stated in the Bid Form, the Owner may request all Bidders to agree to an extension of the originally specified bid

acceptance period. In such case the bid acceptance period will be extended subject to the Bidder, whose bid the Owner wishes to accept, having agreed in writing to the extension.

1.20 BID ACCEPTANCE

- .1 The lowest or any bid will not necessarily be accepted and the Owner may reject any and all bids.
- .2 The Contract will be established if and when the successful Bidder receives from the Owner a written notification accepting the bid without any conditions. If the Owner's written notification accepting the bid contains, or is subject to, any conditions, the Contract will be established if and when the Bidder accepts all such conditions in writing or when the parties execute the agreement.
- .3 If the lowest compliant bid exceeds the Owner's budget, and the Owner is unwilling or unable to award a contract at the bid price, the Owner may:
 - .1 negotiate, with the lowest compliant Bidder only, changes to the Bid Documents and a reduced bid price acceptable to the Owner, or
 - .2 invite the three lowest compliant Bidders (only) to re-bid on modified Bid Documents under a new bid call.

1.21 INTERPRETATION AND MODIFICATION OF BID DOCUMENTS

- .1 If an inquiry requires an interpretation or modification of the Bid Documents, the response to that inquiry will be issued in the form of a written Addendum only, to ensure that all Bidders base their bids on the same information.
- .2 Replies to inquiries or interpretations or modifications of the Bid Documents made by e-mail, verbally, or in any manner other than a written Addendum, will not form part of the Bid Documents and will not be binding.

1.22 ADDENDA

- .1 Addenda may be issued to modify the Bid Documents in response to Bidder inquiries or as may be considered necessary.
- .2 All addenda issued during the bid period will become part of the Bid Documents.
- .3 No addenda will be issued later than 2 Working Days before the bid closing time.
- .4 Each Bidder shall ascertain before bid submission that it has received all addenda issued during the bid period and shall indicate in the Bid Form the addendum number(s) of all addenda received.

1.23 INQUIRIES

- .1 Direct all inquiries in writing, via e-mail to:

Dustin Lendvay
Berry Architecture + Associates
E-mail: tendering@berryarchitecture.ca
- .2 Submit inquiries as early as possible in the bid period and not less than 3 Working Days before the bid closing time. Inquiries received after this time may not receive a response.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 00 41 13
BID FORM

Part 1 General

1.1 BID FORM

.1

Project/Contract: Western Financial Place Evaporative Condenser Replacement

From (Bidder):

(business name)

(street address or postal box number)

(city/town, province, and postal code)

To (Owner): City of Cranbrook
Submit through BC Bids.

We, the undersigned, having examined the Bid Documents for the above named project/contract, including Addendum Number(s) _____, and having visited the Place of the Work, hereby offer to perform the Work in accordance with the Bid Documents, for the stipulated [base bid] price of:

\$ _____ in Canadian dollars, excluding Value Added Taxes.
(amount in figures)

\$ _____

in Canadian dollars, excluding Value Added Taxes.
(amount in words)

We, the undersigned, declare that:

1. we are qualified to perform the Work in accordance with the Bid Documents and our bid price covers all of our obligations and things necessary for the performance of the Work,
2. we agree to attain Substantial Performance of the Work by **July 16, 2027**.
3. we have arrived at this bid without collusion with any competitor,
4. all bid form supplements called for by the Bid Documents form an integral part of this bid, and
5. this bid is open to acceptance by the Owner for a period of 60 calendar days from the bid closing time.

Signatures

Signed and submitted by:

(business name)

(name and title of authorized signing representative)

(signature of authorized signing representative)

(name of witness, if business is sole proprietorship)

(signature of witness, if business is sole proprietorship)

(name and title of authorized signing representative)

(signature of authorized signing representative)

Dated this _____ day of _____,
_____, 20_____.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 00 43 36
BID FORM SUPPLEMENT - LIST OF CONTRACTORS

Part 1 General

1.1 FORM

.1 Project/Contract: CoC - Western Financial Place Evaporative Condenser Replacement

From (Bidder):

(business name)

We, the above named Bidder, have received bids from the Subcontractors or Suppliers named below for the items of work requested, and are prepared to accept these names for the performance of these items of work.

Submit within 2 hours of Bid Closing.

1.2 FORM

.1

Item of Work	Name of Subcontractor	Cost Breakdown
General Conditions		
Demolition		
Concrete		
Mechanical		
Earthwork, Landscaping		
Chain Link Fence		
Other:		
Total:		

1.3 SIGNING

.1 Signatures

Signed and submitted by:

(business name)

(name and title of authorized signing representative)

(signature of authorized signing representative)

(name of witness, if business is sole proprietorship)

(signature of witness, if business is sole proprietorship)

(name and title of authorized signing representative)

(signature of authorized signing representative)

Dated this _____ day of _____,
_____, 20____.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 00 70 00 CONDITIONS OF CONTRACT

Part 1 General

1.1 FORM OF CONTRACT

- .1 The form of Contract, including the Agreement, Definitions, and General Conditions is CCDC 2 – 2020, Stipulated Price Contract, subject to the modifications specified in Section 00 73 00 – Supplementary Conditions.

1.2 CONTRACT COPYRIGHT AND AVAILABILITY

- .1 The CCDC form of Contract is a copyrighted document published by the Canadian Construction Documents Committee. It is incorporated into these Bid Documents by reference. It is available for purchase from any CCDC document outlet. Refer to ccdc.org.

1.3 CONTRACT PREPARATION FOR SIGNING

- .1 The Consultant will prepare two copies of the form of Contract for signing by the Contractor and the Owner after notice of award. Each copy will be comprised of the CCDC form of Contract with a CCDC copyright seal affixed, with a completed Agreement form, and with other Contract Documents referenced or appended.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 00 73 63 CONTRACT SECURITY REQUIREMENTS

Part 1 General

1.1 PERFORMANCE BOND

- .1 Provide security for performance of the Contract in the form of a Performance Bond for 50% of the Contract Price.
- .2 Bond shall be in accordance with the latest edition of the Canadian Construction Documents Committee (CCDC) Standard Form of Performance Bond, CCDC 221.
- .3 Bond shall be issued by a duly licensed surety company authorized to transact the business of suretyship in the province or territory of the Place of the Work.
- .4 Bond shall name Owner as the obligee and shall be signed, sealed, and dated by both Contractor and surety company.
- .5 Submit bond to Owner within 14 days after contract award.

1.2 LABOUR AND MATERIAL PAYMENT BOND

- .1 Provide security for payment of labour and material provided in the performance of the Work in the form of a Labour and Material Payment Bond for 50% of the Contract Price.
- .2 Bond shall be in accordance with the latest edition of the Canadian Construction Documents Committee (CCDC) Standard Form of Labour and Material Payment Bond, CCDC 222.
- .3 Bond shall be issued by a duly licensed surety company authorized to transact the business of suretyship in the province or territory of the Place of the Work.
- .4 Bond shall name Owner as the obligee and shall be signed, sealed, and dated by both Contractor and surety company.
- .5 Submit bond to the Owner within 14 days after contract award.

1.3 CERTIFIED CHEQUE OR BANK DRAFT

- .1 The Contractor may provide, in lieu of the specified Performance Bond, security for performance of the Contract in the form of a certified cheque or bank draft for 10% of the Contract Price.
- .2 The certified cheque or bank draft shall be in favour of Owner.
- .3 Submit certified cheque or bank draft to the Owner within 14 days after contract award. Alternatively, and subject to mutual agreement, the Owner may retain as contract security a certified cheque or bank draft provided as bid security.
- .4 The certified cheque or bank draft will be deposited and the monies will not be returned to the Contractor, in whole or in part, until satisfactory performance of all of the Contractor's obligations under the Contract, including those arising during the warranty period.
- .5 Provided the Contractor has satisfactorily fulfilled all of its obligations under the Contract, the Owner will return to the Contractor the monies provided as contract security without interest, no later than 60 days after Substantial Performance of the Work.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 11 00 SUMMARY OF WORK

Part 1 General

1.1 WORK OF THIS CONTRACT

- .1 *Work* of this *Contract* comprises of the Evaporative Condenser Replacement at Western Financial Place.
- .2 Municipal Address: 1777 2 Street N, Cranbrook.
- .3 Schedule:
 - .1 On site work to occur in June, 2027, during the annual facility shut down for two weeks for annual maintenance.
- .4 Contractor to provide onsite security during onsite construction activities.
- .5 Contractor to coordinate with onsite City of Cranbrook personnel during construction.
- .6 Contractor to provide environmental protection plans required for spill/release of ammonia.
- .7 All on-site personnel to provide criminal record checks.
- .8 Contractor to coordinate site usage with the adjacent construction site for the new daycare facility.

1.2 DIVISION OF WORK

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

1.3 SPECIFICATIONS LANGUAGE AND STYLE

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

1.4 CONTRACT DOCUMENTS FOR CONSTRUCTION PURPOSES

- .1 *Owner* will supply *Contractor* with a complete set of *Contract Documents* in electronic form before commencement of the *Work*. *Contractor* may print hard copies for construction purposes as required.

1.5 DOCUMENTS AT THE SITE

- .1 Keep the following documents at *Place of the Work*, stored securely and in good order and available to *Owner* and *Consultant* in electronic form:
 - .1 Current *Contract Documents*, including *Drawings*, *Specifications* and addenda.
 - .2 *Change Orders*, *Change Directives*, and *Supplementary Instructions*.
 - .3 Reviewed *Shop Drawings*, *Product* data and samples.
 - .4 Field test reports and records.
 - .5 Construction progress schedule.

- .6 Meeting minutes.
- .7 Manufacturer's certifications.
- .8 Permits, inspection certificates, and other documents required by authorities having jurisdiction.
- .9 Current as-built drawings.

1.6 CONTRACTOR'S USE OF PREMISES

- .1 Confine *Construction Equipment*, *Temporary Work*, storage of *Products*, waste products and debris, and all other construction operations to limits required by laws, ordinances, permits, and *Contract Documents*, whichever is most restrictive. Do not unreasonably encumber *Place of the Work*.
- .2 Emergency Building Exits During Construction to be maintained.
- .3 Construction Operations: Limited to areas noted on Drawings.
- .4 Contractor is not to interact with public, and staff.
- .5 Smoking, drug use, and alcohol is not permitted on the site.
- .6 Noise generating work to follow bylaws.

1.7 WASTE AND RECYCLING

- .1 Although this project is not pursuing sustainability accreditation, the Consulting Team and Owner encourage all Contractors employed on this project to employ a minimum level of environmental stewardship and sustainability. At a minimum, the Consulting Team and Owner encourage the Contractors to achieve a minimum of 50% construction waste diversion and active recycling activities through sorting of at least three (3) material streams. Three possible streams include but are not limited to: metals, plastics, and cardboard.
- .2 Environmental stewardship should also be preferred by Contractors when sourcing materials. This could include sourcing elements certified from FSC (Forest Stewardship Council), factory-constructing items to limit waste, and prioritizing local or Canadian suppliers where possible and feasible.

1.8 CONSULTANT PROJECT SOFTWARE

- .1 Berry Architecture will be using a software called Part3 Technology, to administer Consultant construction administration paperwork.
 - .1 Project software (Part3 Technology) administered by the Consultant will be used for purposes of managing communication and documents during the construction stage between Consultants, the Owner, and the Contractor.
 - .2 Contractor to prepare Construction Administration paperwork in PDF form and upload them to the Architect's web-based Project software website. Enter required data in a web-based software site to fully identify the submittal.
 - .3 Part3 Technology has the ability to connect to some Contractor's project management software (Procore).

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 14 00 WORK RESTRICTIONS

Part 1 General

1.1 RESTRICTIONS ON USE OF PREMISES

- .1 Limit use of premises for *Work* to allow for:
 - .1 *Owner* occupancy.
 - .2 Public usage.
- .2 Coordinate use of premises under direction of *Owner* and *Consultant*.

1.2 WORK SEQUENCE

- .1 Schedule and construct *Work* in stages to accommodate *Owner's* continued use of premises during construction.

1.3 OWNER OCCUPANCY

- .1 *Owner* will occupy premises during entire construction period.
- .2 Cooperate with *Owner* in scheduling operations to minimize disruptions and to facilitate *Owner* usage.

1.4 RESTRICTED HOURS OF WORK IN OCCUPIED FACILITIES

- .1 *Work* may be performed during *Owner's* normal business hours which are Monday to Friday from 8:00 to 05:00.
- .2 Allow for hours of work restrictions in construction progress schedule.

1.5 NOISY WORK RESTRICTIONS IN OCCUPIED FACILITIES

- .1 Schedule excessively noisy work to avoid disturbance to building occupants. Perform excessive noise generating work outside of *Owner's* business hours.
- .2 Use powder actuated devices only with *Consultant's* written permission.

1.6 MAINTAINING LIFE SAFETY SYSTEMS IN OCCUPIED FACILITIES

- .1 Maintain operational life safety systems and public access to exits in occupied areas during all stages of the *Work*.
- .2 Determine nature and exact locations of existing fire and smoke sensors prior to the commencement of the *Work*. Avoid direct or indirect jarring while working in adjacent areas and exercise caution to avoid triggering these devices.
- .3 Be responsible for costs incurred by *Owner* on account of false fire alarms activated as a result of the execution of the *Work* without adequate precautions.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 25 00 SUBSTITUTION PROCEDURES

Part 1 General

1.1 DEFINITION

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

1.2 SUBSTITUTION PROCEDURES

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

1.3 SUBMISSION REQUIREMENTS FOR PROPOSED SUBSTITUTIONS

- .1 Include with each proposed Substitution the following information:
 - .1 Identification of the Substitution, including product name and manufacturer's name, address, telephone numbers, and web site.
 - .2 Reason(s) for proposing the Substitution.
 - .3 A statement verifying that the Substitution will not affect the *Contract Price* and *Contract Time* or, if applicable, the amount and extent of a proposed increase or decrease in *Contract Price* and *Contract Time* on account of the Substitution.

- .4 A statement verifying that the Substitution will not affect the performance [or warranty] of other parts of the *Work*.
- .5 Manufacturer's *Product* literature for the Substitution, including material descriptions, compliance with applicable codes and reference standards, performance and test data, compatibility with contiguous materials and systems, and environmental considerations.
- .6 Product samples as applicable.
- .7 A summarized comparison of the physical properties and performance characteristics of the specified *Product* and the Substitution, with any significant variations clearly highlighted.
- .8 Availability of maintenance services and sources of replacement materials and parts for the Substitution, as applicable, including associated costs and time frames.
- .9 If applicable, estimated life cycle cost savings resulting from the Substitution.
- .10 Details of other projects and applications where the Substitution has been used.
- .11 Identification of any consequential changes in the *Work* to accommodate the Substitution and any consequential effects on the performance of the *Work* as a whole. A later claim for an increase to the *Contract Price* or *Contract Time* for other changes in the *Work* attributable to the Substitution will not be considered.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

Part 1 General

1.1 SCHEDULE OF LABOUR RATES

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

1.2 SCHEDULE OF EQUIPMENT RATES

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

1.3 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE ORDERS

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

1.4 CHANGE ORDER PROCEDURES

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

1.5 FEES FOR OVERHEAD AND PROFIT – CHANGE ORDERS

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

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

1.6 1.7 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE DIRECTIVES

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

1.7 CHANGE DIRECTIVE PROCEDURES

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

1.8 FEES FOR OVERHEAD AND PROFIT – CHANGE DIRECTIVES

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

1.9 SUPPLEMENTAL INSTRUCTIONS

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

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 29 00 PAYMENT PROCEDURES

Part 1 General

1.1 SCHEDULE OF VALUES

- .1 Prior to the first application for payment, submit for *Consultant's* review an initial schedule of values. Modify the initial schedule of values if and as requested by *Consultant*. Obtain *Consultant's* written acceptance of the initial schedule of values prior to the first application for payment.
- .2 Together with the first and all subsequent applications for payment, submit updated versions of the schedule of values to indicate the values, to the date of application for payment, of work performed and *Products* delivered to *Place of the Work*.
- .3 Provide the schedule of values in an electronic spreadsheet format that provides for inclusion of the following information:
 - .1 Identifying information including title and location of the *Work*, name of *Contractor*, number and date of application for payment, and period covered by the application for payment.
 - .2 A work breakdown structure based on *Contractor*, *Subcontractor* and sub-*Subcontractor* work breakdown. Include separate line items for closeout procedures including closeout submittals, demonstration and training, start-up and testing, and commissioning.
 - .3 Provisions for approved *Change Orders* allowances so that the breakdown amounts indicated in the schedule of values aggregate to the current total *Contract Price*. Also provide for indicating the estimated value of *Change Directives* within the schedule of values, separately from the current total *Contract Price*.
 - .4 For each item in the work breakdown structure, provide as a minimum the following information, under headings as indicated:
 - .1 Breakdown Amount: A dollar amount, including an appropriate pro rata portion of *Contractor's* overhead and profit.
 - .2 Performed to Date: The value of *Work* performed and *Products* delivered to *Place of the Work* up to the date of the application for payment, stated as a percentage of the *Contract Price* and in dollars.
 - .3 Previously Performed: The value of *Work* performed and *Products* delivered to the *Place of the Work* for which payment has been previously certified, stated in dollars.
 - .4 Current Period: The value of *Work* performed and *Products* delivered to *Place of the Work* for which *Contractor* is currently applying for payment, stated in dollars.
 - .5 Balance to Complete: The value of *Work* not yet performed and *Products* not yet delivered to *Place of the Work*, stated in dollars.

1.2 CASH FLOW PROJECTION

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

1.3 WORKERS' COMPENSATION CLEARANCE

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

1.4 STATUTORY DECLARATIONS

- .1 Submit a statutory declaration in the form of CCDC 9A – Statutory Declaration of Progress Payment Distribution by *Contractor* with each application for payment except the first.

1.5 PAYMENT FOR PRODUCTS STORED OFF SITE

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

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 31 19 PROJECT MEETINGS

Part 1 General

1.1 CONSTRUCTION START UP MEETING

- .1 Promptly after *Contract* award, *Consultant* will establish the time and location of a construction start-up meeting to review and discuss administrative procedures and responsibilities. *Consultant* will notify *Contractor* at least 5 *Working Days* before the meeting.
- .2 Senior representatives of *Owner*, *Consultant*, and *Contractor*, including *Contractor's* project manager and site superintendent, shall be in attendance.
- .3 *Consultant's* representative will chair the meeting and record and distribute the minutes.
- .4 Agenda will include following:
 - .1 Appointment of official representatives of *Owner*, *Contractor*, *Subcontractors*, *Consultant*, and subconsultants.
 - .2 *Project* communications.
 - .3 *Contract Documents* for construction purposes.
 - .4 Documents at the site.
 - .5 *Contractor's* use of premises.
 - .6 *Owner-supplied Products*.
 - .7 Work restrictions.
 - .8 Cash allowances.
 - .9 Substitution procedures.
 - .10 *Contract* modification procedures.
 - .11 Payment procedures.
 - .12 Construction progress meetings.
 - .13 Construction progress schedule, including long lead time items.
 - .14 Submittals schedule and procedures.
 - .15 Quality requirements, including testing and inspection procedures.
 - .16 *Contractor's* mobilization.
 - .17 Temporary utilities.
 - .18 Existing utility services.
 - .19 Construction facilities.
 - .20 Temporary barriers and enclosures.
 - .21 Temporary controls.
 - .22 Field engineering and layout of work.
 - .23 Site safety.
 - .24 Site security.
 - .25 Cleaning and waste management.
 - .26 Closeout procedures and submittals.
 - .27 Other items.

1.2 CONSTRUCTION PROGRESS MEETINGS

- .1 Schedule regular **bi-weekly** construction progress meetings for the duration of the *Work*. *Consultant* will prepare meeting agendas, chair the meetings, and record and distribute the minutes.
- .2 Location of Meetings:
 - .1 MS Teams.
 - .2 On site in a meeting room.
- .3 *Consultant* will record in the meeting minutes significant decisions and identify action items and action dates by attendees or the parties they represent.
- .4 *Consultant* will distribute copies of minutes within three Working Days after each meeting to meeting attendees and any affected parties who may not be in attendance.
- .5 Ensure that *Subcontractors* attend as and when appropriate to the progress of the *Work*.
- .6 Agenda for each meeting shall include the following, as a minimum:
 - .1 Approval of minutes of previous meeting.
 - .2 Work progress since previous meeting.
 - .1 Contractor to provide a written progress update prior to the meeting.
 - .3 Field observations, including any problems, difficulties, or concerns.
 - .4 Construction progress schedule.
 - .1 Contractor to provide a written two week forecast prior to the meeting.
 - .5 Submittals schedule.
 - .6 Proposed changes in the *Work*.
 - .7 Requests for information.
 - .8 Site safety issues.
 - .9 Other business.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

Part 1 General

1.1 SUMMARY

- .1 This Section specifies *Contractor's* responsibilities for preparation and submission of schedules and other documentation related to tracking construction progress.
- .2 The purpose of submitting progress schedules is to:
 - .1 inform *Owner* and *Consultant* of actual progress versus planned progress, and
 - .2 provide assurance that scheduling issues are being proactively identified and addressed in a timely manner, and that planned progress is being maintained as closely as possible.

1.2 CONSTRUCTION PROGRESS SCHEDULE

- .1 Format and Content:
 - .1 Prepare schedule in the form of a Critical Path Method (CPM) Gantt chart using appropriate scheduling software.
 - .2 Provide a work breakdown structure identifying key activities, work packages, and major milestones, including long delivery *Products*, inspection and testing activities, preparation and review of mock-ups, *Owner* decisions for cash allowances, shutdown or closure activities, delivery of *Owner* supplied *Products*, *Owner* performed work, demonstration and training activities, and similar items, at a sufficient level of detail to effectively manage construction progress.
 - .3 Indicate milestone dates for *Ready-for-Takeover* and *Substantial Performance of the Work*.
- .2 Submission:
 - .1 Submit initial schedule to *Owner* and *Consultant* within 15 *Working Days* after *Contract* award.
 - .2 Submit schedule via e-mail and project web site as .pdf files.
 - .3 *Consultant* will review format and content of initial schedule and request necessary changes, if any, within 10 *Working Days* after receipt.
 - .4 If changes are required, resubmit finalized initial schedule within 10 *Working Days* after return of review copy.
 - .5 Submit updated progress schedule monthly to *Owner* and *Consultant*, indicating actual and projected start and finish dates with report date line and progress, activity relationships, critical path.
 - .6 Include a written report with each updated progress schedule. Indicate work status to date comparing baseline to actual progress, current forecasts, identifying problem areas, anticipated delays and impact on schedule, and planned corrective actions.

1.3 SUBMITTALS SCHEDULE

- .1 Format and Content:
 - .1 Prepare schedule identifying all required *Shop Drawing*, *Product* data, and sample submissions, including samples required for testing and including those for *Owner* supplied *Products*.
 - .2 Prepare schedule in electronic format.

- .3 Provide a separate line for each required submittal, organized by *Specifications* section names and numbers, and further broken down by individual *Products* and systems as required.
- .4 For each required submittal, show planned latest date for return of reviewed submittal without causing delay.
- .5 Allow time in schedule for resubmission of submittals, should resubmission be necessary.
- .2 Submission:
 - .1 Submit initial schedule to *Consultant* within 15 *Working Days* after *Contract* award.
 - .2 Submit schedule via e-mail and project web site as .pdf files.
 - .3 Consultant will review format and content of initial schedule and request necessary changes, if any, within 5 *Working Days* after receipt.
 - .4 If changes are required, resubmit finalized schedule within 5 *Working Days* after return of review copy.
 - .5 Submit updated submittals schedule monthly to *Owner* and *Consultant*.

1.4 SCHEDULE MANAGEMENT

- .1 A schedule submitted as specified and accepted by *Consultant* shall become the baseline schedule and shall be used as the baseline for updates.
- .2 At each regular progress meeting, review and discuss current construction progress and submittals schedules with *Consultant* [and *Owner*], including activities that are behind schedule and planned measures to regain schedule slippage in key areas on or near the critical path.
- .3 Activities considered behind schedule are those with start or completion dates later than the dates shown on the baseline schedule.

1.5 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS

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

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 33 00 SUBMITTAL PROCEDURES

Part 1 General

1.1 ADMINISTRATIVE

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

- .4 *Contractor's* stamp, date, and signature of *Contractor's* authorized representative responsible for *Shop Drawing* review, indicating that each *Shop Drawing* has been reviewed for compliance with *Contract Documents* and, where applicable, that field measurements have been verified.
- .5 Details of appropriate portions of the *Work* as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationships to other parts of the *Work*.
- .5 *Product* data submittals shall include material safety data sheets (MSDS) for all controlled *Products*.
- .6 Submit electronic copy of *Shop Drawings* where specified in the technical *Specifications*.
- .7 Submit electronic copy of *Product* data sheets or brochures where specified in the technical *Specifications*.
- .8 Where a submittal includes information not applicable to the *Work*, clearly identify applicable information and strike out non-applicable information.
- .9 Supplement standard information to include details applicable to *Project*.
- .10 Allow 5 *Working Days* for *Consultant's* review of each submittal and incorporate in submittals schedule specified in Section 01 32 00 – Construction Progress Documentation. Allow additional 5 *Working Days* where sub-*Consultant* review is required.
- .11 If upon *Consultant's* review no errors or omissions are discovered, or if only minor corrections are required as indicated, submittal will be returned and fabrication or installation of *Work* may proceed.
- .12 If upon *Consultant's* review significant errors or omissions are discovered, a so noted copy will be returned for correction and resubmission. Do not commence fabrication or installation.
- .13 *Consultant's* notations on submittals are intended to ensure compliance with *Contract Documents* and are not intended to constitute a change in the *Work* requiring change to the *Contract Price* or *Contract Time*. If *Contractor* considers any *Consultant's* notation to be a change in the *Work*, promptly notify *Consultant* in writing before proceeding with the *Work*.
- .14 Resubmit corrected submittals through same procedure indicated above, before any fabrication or installation of the *Work* proceeds. When resubmitting, notify *Consultant* in writing of any revisions other than those requested by *Consultant*.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 40 00 QUALITY REQUIREMENTS

Part 1 General

1.1 REFERENCE STANDARDS

- .1 "Reference standards" means consensus standards, trade association standards, guides, and other publications expressly referenced in *Contract Documents*.
- .2 Where an edition or version date is not specified, referenced standards shall be deemed to be the latest edition or revision issued by the publisher at the time of bid closing. However if a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the regulatory referenced edition or version shall apply.
- .3 Reference standards establish minimum requirements. If *Contract Documents* call for requirements that differ from a referenced standard, the more stringent requirements shall govern.
- .4 If compliance with two or more reference standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to *Consultant* for clarification.
- .5 Within the *Specifications*, reference may be made to the following standards writing, testing, or certification organizations by their acronyms or initialisms:
 - .1 AA - Aluminum Association
 - .2 ACI - American Concrete Institute
 - .3 AISC - American Institute of Steel Construction
 - .4 ANSI - American National Standards Institute
 - .5 ASME - American Society of Mechanical Engineers
 - .6 ASTM - American Society for Testing and Materials
 - .7 AWMAC - Architectural Woodwork Manufacturers Association of Canada
 - .8 AWWA - American Water Works Association
 - .9 CaGBC - Canadian Green Building Council
 - .10 CGSB - Canadian General Standards Board
 - .11 CISC - Canadian Institute of Steel Construction
 - .12 CPCI - Canadian Prestressed Concrete Institute
 - .13 CSA - Canadian Standards Association
 - .14 CSSBI - Canadian Sheet Steel Building Institute
 - .15 CWB – Canadian Welding Bureau
 - .16 ICEA - Insulated Cable Engineers Association
 - .17 IEEE - Institute of Electrical and Electronics Engineers
 - .18 IGMAC – Insulating Glass Manufacturers Association of Canada
 - .19 LEED - Leadership in Energy and Environmental Design
 - .20 MPP – Master Painters Institute
 - .21 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry
 - .22 NAAMM - National Association of Architectural Metal Manufacturers
 - .23 NEMA - National Electrical Manufacturers Association
 - .24 NFPA - National Fire Protection Association

- .25 NHLA - National Hardwood Lumber Association
- .26 NLGA - National Lumber Grades Authority
- .27 SSPC – The Society for Protective Coatings
- .28 TTMAC - Terrazzo, Tile and Marble Association of Canada
- .29 ULC - Underwriters' Laboratories of Canada

1.2 INSPECTION AND TESTING AGENCY REPORTS

- .1 For inspection and testing required by *Contract Documents* or by regulatory requirements, and performed by *Contractor* retained inspection and testing agencies, submit to *Consultant* and *Owner* copies of reports. Submit within 5 days after completion of inspection and testing.
- .2 For inspection and testing performed by *Owner* retained inspection and testing agencies, copies of inspection and testing agency reports will be provided to *Contractor*.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 41 00 REGULATORY REQUIREMENTS

Part 1 General

1.1 SECTION INCLUDES

- .1 Laws, notices, permits and fees.

1.2 LAWS, NOTICES, PERMITS AND FEES

- .1 The laws of the Place of the Work shall govern the Work.
- .2 The Owner shall obtain and pay for the building permit, permanent easements and rights of servitude. The Contractor shall be responsible for permits, licenses or certificates necessary for the performance of the Work that were in force at the date of executing the Agreement.
- .3 Give the required notices and comply with the laws, ordinances, rules, regulations or codes which are or become in force during the performance of the Work and which relate to the Work, to the preservation of the public health and to construction safety.
- .4 If the Contractor knowingly performs or allows work to be performed that is contrary to any laws, ordinances, rules, regulations or codes, the Contractor shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations or codes.
- .5 Determine detailed requirements of authorities having jurisdiction.
- .6 Pay construction damage deposits levied by municipality in connection with the issuance of a building permit.

1.3 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: If material resembling asbestos is encountered in course of demolition work, immediately stop work and notify Consultant.
- .2 Contractor is responsible to remove hazardous materials in the construction area. Assume existing gypsum board walls contain asbestos. Refer to Schedule B for the hazardous material report.

END OF SECTION

SECTION 01 51 00 TEMPORARY UTILITIES

Part 1 General

1.1 TEMPORARY UTILITIES - GENERAL

- .1 Provide temporary utilities as specified and as otherwise necessary to perform the *Work* expeditiously.
- .2 Remove temporary utilities after use.

1.2 TEMPORARY WATER SUPPLY

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

1.3 TEMPORARY HEATING AND VENTILATION

- .1 *Contractor* may connect to and use *Owner's* existing supply of natural gas for temporary use during construction, subject to existing available volume and pressure. Usage at no cost to *Contractor*.
 - .1 *Contractor* to arrange and pay for necessary connection and disconnections.
- .2 Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters.
- .3 Provide temporary heat for the *Work* as required to:
 - .1 Facilitate progress of *Work*.
 - .2 Protect the *Work* against dampness and cold.
 - .3 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored *Products*.
 - .4 Maintain specified minimum ambient temperatures and humidity levels for storage, installation and curing of *Products*.
 - .5 After building is enclosed, maintain interior temperature of minimum 10 degrees C.
- .4 Provide temporary ventilation for the *Work* as required to:
 - .1 Prevent accumulations of fumes, exhaust, vapours, gases and other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe work environment meeting applicable regulatory requirements.
 - .2 Ensure that hazardous, noxious, or volatile substances do not migrate to *Owner* occupied spaces.
 - .3 Ventilate temporary sanitary facilities.
- .5 Do not use permanent building heating and ventilation systems during construction.

1.4 TEMPORARY ELECTRICAL POWER AND LIGHTING

- .1 Connect to and use *Owner's* existing electrical supply for temporary use during construction. Usage at no cost to *Contractor*.
- .2 Arrange and pay for necessary connections and disconnections of temporary power and lighting in accordance with regulatory requirements.

1.5 EXISTING BUILDING HEATING, VENTILATION, POWER, AND LIGHTING

- .1 Existing building heating, ventilation, power, and lighting may be relied upon and used during construction except during hours or days when the building is not operational.
- .2 Coordinate and make arrangements with the building operator and pay any costs required for provision of these services during hours or days when the building is not operational.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 52 00 CONSTRUCTION FACILITIES

Part 1 General

1.1 CONSTRUCTION FACILITIES - GENERAL

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

1.2 CONSTRUCTION PARKING

- .1 Limited parking will be permitted at *Place of the Work* at locations provided by the Owner, provided it does not disrupt continuing operation of the facility.
 - .1 Contractor on-site parking to be determined at the start-up meeting, will not conflict with the adjacent day care construction area. Parking will likely be on the other side of the zamboni bay.

1.3 VEHICULAR ACCESS

- .1 Provide and maintain adequate access to *Place of the Work*.
- .2 Existing roads at *Place of the Work* may be used for access to *Place of the Work*, provided *Contractor* assumes responsibility for any damage caused by construction traffic, and prevents or promptly cleans up any mud tracking or material spillage.

1.4 SITE OFFICES

- .1 Provide a temperature controlled and ventilated office, with suitable lighting, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

1.5 SANITARY FACILITIES

- .1 Contractor may use Western Financial Place assigned washrooms. Contractor may provide port-a-potties, if preferred.
- .2 Keep sanitary facilities clean and fully stocked with the necessary supplies.
- .3 Assigned washroom to be kept in the original condition.

1.6 FIRE PROTECTION

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

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 56 00 TEMPORARY BARRIERS AND ENCLOSURES

Part 1 General

1.1 BARRIERS AND ENCLOSURES - GENERAL

- .1 Provide temporary barriers and enclosures necessary to protect the public and building occupants and to secure *Place of the Work* during performance of the *Work*.
- .2 Comply with applicable regulatory requirements.
- .3 Maintain temporary barriers and enclosures in good condition for the duration of the *Work*.
- .4 Remove temporary barriers and enclosures from *Place of the Work* when no longer required.

1.2 FENCING

- .1 Erect temporary security and safety site fencing of type and height determined by *Contractor*, subject to applicable regulatory requirements.
- .2 Erect temporary security and safety site fencing, minimum 2.0 m high, using self-supporting wire fence sections enclosing entire site. Maintain site fencing in good repair until removed.
- .3 Provide lockable access gates as required to facilitate construction access.

1.3 EXTERIOR HOARDING

- .1 Erect temporary exterior site hoarding to comply with applicable regulatory requirements and as follows:
 - .1 Use lumber framing and, minimum 13 mm thick exterior grade plywood.
 - .2 Provide lockable access gates for *Construction Equipment* and lockable pedestrian doors as required to facilitate construction access.
 - .3 Erect and maintain pedestrian walkways including roof and side covers, complete with pedestrian signage and electrical lighting.

1.4 WEATHER ENCLOSURES

- .1 Provide weather tight enclosures to unfinished duct openings into the building.
- .2 Design weather enclosures to withstand wind pressure and snow loading requirements.

1.5 FIRE ROUTES

- .1 Maintain fire access routes, including overhead clearances, for use by emergency response vehicles.

1.6 PROTECTION OF BUILDING FINISHES

- .1 Provide necessary temporary barriers and enclosures to protect existing and completed or partially completed finished surfaces from damage during performance of the *Work*.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 57 00 TEMPORARY CONTROLS

Part 1 General

1.1 TEMPORARY CONTROLS - GENERAL

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

1.2 DUST AND PARTICULATE CONTROL

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

1.3 SITE DRAINAGE

- .1 Maintain grades to ensure proper site drainage.
- .2 Prevent surface water runoff from leaving the site except as otherwise provided by site grading and stormwater management plan.
- .3 Prevent precipitation from infiltrating or from directly running off stockpiled waste materials. Cover stockpiled waste materials with an impermeable liner during periods of work stoppage including at end of each *Working Day*.
- .4 Control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other work areas as required to prevent erosion and sedimentation.
- .5 Control surface drainage by ensuring that gutters are kept open and water is not directed across or over pavements or sidewalks, except through pipes or properly constructed troughs. Ensure that runoff from unfinished areas is intercepted and diverted to suitable outlets.

1.4 POLLUTION CONTROL

- .1 Take measures to prevent contamination of soil, water, and atmosphere through uncontrolled discharge of noxious or toxic substances and other pollutants, potentially causing environmental damage.
- .2 Be prepared, by maintaining appropriate materials, equipment, and trained personnel on site, to intercept, clean up, and dispose of spills or releases that may occur. Promptly report spills and releases that may occur to:
 - .1 authority having jurisdiction,
 - .2 person causing or having control of pollution source, if known, and
 - .3 *Owner and Consultant*.

- .3 Contact manufacturer of pollutant, if known and applicable, to obtain material safety data sheets (MSDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.
- .4 Take immediate action to contain and mitigate harmful effects of the spill or release.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 61 00 COMMON PRODUCT REQUIREMENTS

Part 1 General

1.1 GENERAL

- .1 Provide *Products* that are not damaged or defective, and suitable for purpose intended, subject to specified requirements. If requested by *Consultant*, furnish evidence as to type, source and quality of *Products* provided.
- .2 Unless otherwise specified, maintain uniformity of manufacture for like items throughout.

1.2 PRODUCT OPTIONS

- .1 Subject to the provisions of Section 01 25 00 –Substitution Procedures:
 - .1 Wherever a *Product* or manufacturer is specified by a single proprietary name, provide the named *Product* only.
 - .2 Wherever more than one *Product* or manufacturer is specified by proprietary name for a single application, provide any one of the named *Products*.
- .2 Wherever a *Product* is specified by reference to a standard only, provide any *Product* that meets or exceeds the specified standard. If requested by *Consultant*, submit information verifying that the proposed *Product* meets or exceeds the specified standard.
- .3 Wherever a *Product* is specified by descriptive or performance requirements only, provide any *Product* that meets or exceeds the specified requirements. If requested by *Consultant*, submit information verifying that the proposed *Product* meets or exceeds the specified requirements.

1.3 PRODUCT AVAILABILITY AND DELIVERY TIMES

- .1 Promptly upon Contract award and periodically during construction, review and confirm *Product* availability and delivery times. Order *Products* in sufficient time to meet the construction progress schedule and the *Contract Time*.
- .2 If a specified *Product* is no longer available, promptly notify *Consultant*. *Consultant* will take action as required.
- .3 If delivery delays are foreseeable, for any reason, promptly notify *Consultant*.
 - .1 If a delivery delay is beyond *Contractor's* control, *Consultant* will provide direction.
 - .2 If a delivery delay is caused by something that was or is within *Contractor's* control, *Contractor* shall propose actions to maintain the construction progress schedule for *Consultant's* review and acceptance.

1.4 STORAGE, HANDLING, AND PROTECTION

- .1 Store, handle, and protect *Products* during transportation to *Place of the Work* and before, during, and after installation in a manner to prevent damage, adulteration, deterioration and soiling.
- .2 Comply with manufacturer's instructions for storage, handling and protection.
- .3 Store packaged or bundled *Products* in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in *Work*.
- .4 Comply with the requirements of the workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, including requirements for labeling and the provision of material safety data sheets (MSDS).
- .5 Store *Products* subject to damage from weather in weatherproof enclosures.
- .6 Store sheet *Products* on flat, solid, supports and keep clear of ground. Slope to shed moisture.

.7 Remove and replace damaged *Products*.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 73 00 EXECUTION

Part 1 General

1.1 SUMMARY

- .1 Except where otherwise specified in technical *Specifications* or otherwise indicated on *Drawings*, comply with requirements of this Section.

1.2 MANUFACTURER'S INSTRUCTIONS

- .1 Install, erect, or apply *Products* in strict accordance with manufacturer's instructions.
- .2 Notify *Consultant*, in writing, of conflicts between *Contract Documents* and manufacturer's instructions where, in *Contractor's* opinion, conformance with *Contract Documents* instead of the manufacturer's instructions may be detrimental to the *Work* or may jeopardize the manufacturer's warranty.
- .3 Do not rely on labels or enclosures provided with *Products*. Obtain written instructions directly from manufacturers.
- .4 Provide manufacturer's representatives with access to the *Work* at all times. Render assistance and facilities for such access so that manufacturer's representatives may properly perform their responsibilities.

1.3 FASTENINGS - GENERAL

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials.
- .2 Prevent electrolytic action and corrosion between dissimilar metals and materials by using suitable non-metallic strips, washers, sleeves, or other permanent separators to avoid direct contact.
- .3 Use non-corrosive fasteners and anchors for securing exterior work.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Do not use fastenings or fastening methods that may cause spalling or cracking of material to which anchorage is made.

1.4 FASTENINGS - EQUIPMENT

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

1.5 FIRE RATED ASSEMBLIES

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

1.6 LOCATION OF FIXTURES, OUTLETS AND DEVICES

- .1 Consider location of fixtures, outlets, and devices indicated on *Drawings* as approximate.
- .2 Locate fixtures, outlets, and devices to provide minimum interference, maximum usable space, and as required to meet safety, access, maintenance, acoustic, and regulatory, including barrier free, requirements.

- .3 Promptly notify *Consultant* in writing of conflicting installation requirements for fixtures, outlets, and devices. If requested, indicate proposed locations and obtain approval for actual locations.

1.7 PROTECTION OF COMPLETED WORK AND WORK IN PROGRESS

- .1 Adequately protect parts of the *Work* completed and in progress from any kind of damage.
- .2 Promptly remove, replace, clean, or repair, as directed by *Consultant*, work damaged as a result of inadequate protection.
- .3 Do not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety or integrity of the *Work*.

1.8 REMEDIAL WORK

- .1 Notify *Consultant* of, and perform remedial work required to, repair or replace defective or unacceptable work. Ensure that properly qualified workers perform remedial work. Coordinate adjacent affected work as required.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 73 29 CUTTING AND PATCHING

Part 1 General

1.1 REQUEST FOR CUTTING, PATCHING, AND REMEDIAL WORK

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

1.2 PRODUCTS

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

1.3 PREPARATION

- .1 Inspect existing conditions in accordance with Section 01 71 00 - Examination and Preparation.
- .2 Provide supports to ensure structural integrity of surroundings; provide devices and methods to protect other portions of the *Work* from damage.
- .3 Provide protection from elements for areas that may be exposed by uncovering work.

1.4 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services' utilities, execute the *Work* at times directed by local governing authorities, with a minimum of disturbance to the *Work*, pedestrian and vehicular traffic, and ongoing *Owner* operations.
- .2 Where the *Work* involves breaking into or connecting to existing services, give *Owner* 48 hours notice for necessary interruption of mechanical or electrical services.
- .3 Maintain excavations free of water.
- .4 Keep duration of interruptions to a minimum.

- .5 Carry out interruptions after regular working hours of occupants, preferably on weekends, unless *Owner's* prior written approval is obtained.
- .6 Protect and maintain existing active services. Record location of services, including depth, on as-built drawings.
- .7 Construct or erect barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures as required to protect pedestrian and vehicular traffic.

1.5 CUTTING, PATCHING, AND REMEDIAL WORK

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

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 74 00 CLEANING AND WASTE MANAGEMENT

Part 1 General

1.1 REGULATORY REQUIREMENTS

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

1.2 GENERAL CLEANING REQUIREMENTS

- .1 Provide adequate ventilation during use of volatile or noxious substances. Do not rely on building ventilation systems for this purpose.
- .2 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .3 Prevent cross-contamination during the cleaning process.
- .4 Notify the *Consultant* of the need for cleaning caused by *Owner* or other contractors.

1.3 PROGRESSIVE CLEANING AND WASTE MANAGEMENT

- .1 Maintain the *Work* in a tidy and safe condition, free from accumulation of waste materials and construction debris.
- .2 Provide appropriate, clearly marked, containers for collection of waste materials and recyclables.
- .3 Remove waste materials and recyclables from work areas, separate, and deposit in designated containers at end of each *Working Day*. Collect packaging materials for recycling or reuse.
- .4 Remove waste materials and recyclables from *Place of the Work* at regular intervals.
- .5 Clean interior building areas prior to start of finish work and maintain free of dust and other contaminants during finishing operations.
- .6 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly finished surfaces nor contaminate building systems.
- .7 Clear snow and ice from public sidewalks as required to comply with applicable municipal regulatory requirements.

1.4 FINAL CLEANING

- .1 Before final cleaning, arrange a meeting at *Place of the Work* to determine the acceptable standard of cleaning. Ensure that *Owner*, *Consultant*, *Contractor* and cleaning company are in attendance.
- .2 Remove from *Place of the Work* surplus *Products*, waste materials, recyclables, *Temporary Work*, and *Construction Equipment* not required to perform any remaining work.
- .3 Provide professional cleaning by a qualified, established cleaning company.
- .4 Lock or otherwise restrict access to each room or area after completing final cleaning in that area.
- .5 Re-clean as necessary areas that have been accessed by *Contractor's* workers prior to *Owner* occupancy.
- .6 Remove stains, spots, marks, and dirt from finished surfaces, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.
- .7 Clean mechanical, electrical, and other equipment. Replace filters for mechanical equipment if equipment is used during construction.

- .8 Remove waste material and debris from crawlspaces and other accessible concealed spaces.
- .9 Sweep clean, power wash, and remove dirt, snow and ice from exterior sidewalks, steps, driveways, roads, parking lots, and other paved surfaces.
- .10 Use leaf blowers to clean landscaped surfaces.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Dispose of waste materials and recyclables at appropriate municipal landfills and recycling facilities in accordance with applicable regulatory requirements.
- .2 Do not burn or bury waste materials at *Place of the Work*.
- .3 Do not dispose of volatile and other liquid waste such as mineral spirits, oil, paints and other coating materials, paint thinners, cleaners, and similar materials together with dry waste materials or on the ground, in waterways, or in storm or sanitary sewers. Collect such waste materials in appropriate covered containers, promptly remove from *Place of the Work*, and dispose of at recycling facilities or as otherwise permitted by applicable regulatory requirements.
- .4 Cover or wet down dry waste materials to prevent blowing dust and debris.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 77 00 CLOSEOUT PROCEDURES

Part 1 General

1.1 READY-FOR-TAKEOVER

- .1 The prerequisites to attaining *Ready-for-Takeover* of the *Work* are described in the General Conditions of the *Contract*.

1.2 INSPECTION AND REVIEW BEFORE READY-FOR-TAKEOVER

- .1 *Contractor's Inspection*: Before applying for the *Consultant's* review to establish *Ready-for-Takeover* of the *Work*:
 - .1 Ensure that the specified prerequisites to *Ready-for-Takeover* of the *Work* are completed.
 - .2 Conduct an inspection of the *Work* to identify defective, deficient, or incomplete work.
 - .3 Prepare a comprehensive and detailed list of items to be completed or corrected.
 - .4 Provide an anticipated schedule and costs for items to be completed or corrected.
- .2 *Consultant's Review*: Upon receipt of the *Contractor's* application for review, together with the *Contractor's* list of items to be completed or corrected, the *Consultant* will review the *Work*. The *Consultant* will advise the *Contractor* whether or not the *Work* is *Ready-for-Takeover* and will provide the *Contractor* with a list of items, if any, to be added to the *Contractor's* list of items to be completed or corrected. Provide the *Consultant* with a copy of the *Contractor's* revised list.
- .3 *Consultant's Review*: Upon receipt of the *Contractor's* application for review, together with the *Contractor's* list of items to be completed or corrected, the *Consultant* and the *Contractor* shall arrange a mutually satisfactory agreed date and time to jointly review the *Work*. The *Consultant* will advise the *Contractor* whether or not the *Work* is *Ready-for-Takeover*. Add additional items, if any, to the *Contractor's* list of items to be completed or corrected. Provide the *Consultant* with a copy of the revised list.
- .4 Maintain the list of items to be completed or corrected and promptly correct or complete defective, deficient and incomplete work. The *Contractor's* inspection and *Consultant's* review procedures specified above shall be repeated until the *Work* is *Ready-for-Takeover* and no items remain on the *Contractor's* list of items to be completed or corrected.
- .5 When the *Consultant* determines that the *Work* is *Ready-for-Takeover*, the *Consultant* will notify the *Contractor* and the *Owner* in writing to that effect.

1.3 PREREQUISITES TO FINAL PAYMENT

- .1 After *Ready-for-Takeover* of the *Work* and before submitting an application for final payment in accordance with the General Conditions of Contract:
 - .1 Correct or complete all remaining defective, deficient, and incomplete work.
 - .2 Remove from the *Place of the Work* all remaining surplus *Products*, *Construction Equipment*, and *Temporary Work*.
 - .3 Perform final cleaning and waste removal necessitated by the *Contractor's* work performed after *Ready-for-Takeover*, as specified in Section 01 74 00 – Cleaning and Waste Management.

1.4 SUBSTANTIAL PERFORMANCE OF THE WORK

- .1 The prerequisites to, and the procedures for, attaining substantial performance of the *Work*, or similar such milestone as provided for in the lien legislation applicable to the *Place of the Work*, shall be:

- .1 independent of those for attaining *Ready-for-Takeover* of the *Work*, and
- .2 in accordance with the lien legislation applicable to the *Place of the Work*.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 01 78 00 CLOSEOUT SUBMITTALS

Part 1 General

1.1 OPERATION AND MAINTENANCE MANUAL

- .1 Prepare a comprehensive operation and maintenance manual, in the languages of the *Contract*, using personnel qualified and experienced for this task.
- .2 Submit an initial draft of the operation and maintenance manual for *Consultant's* review. If required by *Consultant's* review comments, revise manual contents and resubmit for *Consultant's* review. If required, repeat this process until *Consultant* accepts the draft manual in writing.
- .3 Submit final version to *Owner* in searchable electronic format.

1.2 OPERATION AND MAINTENANCE MANUAL – GENERAL CONTENT

- .1 Table of contents for each volume.
- .2 Introductory information including:
 - .1 Date of manual submission.
 - .2 Complete contact information for *Consultant*, subconsultants, other consultants, and *Contractor*, with names of responsible parties.
 - .3 Schedule of *Products* and systems indexed to content of volume.
- .3 For each *Product* or system, include complete contact information for *Subcontractors*, *Suppliers* and manufacturers, including local sources for supplies and replacement parts.
- .4 *Product* Data: mark each sheet to clearly identify specific products, options, and component parts, and data applicable to installation. Delete or strike out inapplicable information. Supplement with additional information as required.
- .5 Reviewed *Shop Drawings*.
- .6 Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.
- .7 Warranties.
- .8 Operating and maintenance procedures, incorporating manufacturer's operating and maintenance instructions, in a logical sequence.

1.3 OPERATION AND MAINTENANCE MANUAL - PRODUCTS AND FINISHES CONTENT

- .1 Include *Product* data, with catalogue number, options selected, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured *Products*.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Include an outline of requirements for routine and special inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.
- .4 Include additional content as specified in technical *Specifications* sections.

1.4 OPERATION AND MAINTENANCE MANUAL - WARRANTIES CONTENT

- .1 Separate each warranty with index tab sheets keyed to Table of Contents listing.
- .2 List each warrantor with complete contact information.

- .3 Verify that documents are in proper form and contain full information. Ensure that warranties are for the correct duration and are in *Owner's* name.

1.5 PROJECT RECORD DRAWINGS

- .1 Transfer all information marked up on the as-built drawings during the progress of the *Work* to a master set of record drawing files provided by *Consultant*, in electronic format.
- .2 Mark revised drawings as "RECORD DRAWINGS".
- .3 Submit completed record drawings in electronic form to *Consultant*.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

SECTION 02 41 19 SELECTIVE DEMOLITION

Part 1 General

1.1 ALTERATION PROJECT PROCEDURES

- .1 Materials: As specified in Product sections; match existing Products and work for patching and extending work.
- .2 Employ skilled and experienced installer to perform alteration work.
- .3 Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.
- .4 Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring Products and finishes to specified condition.
- .5 Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.
- .6 Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.
- .7 When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Consultant for review.
- .8 Where a change of plane of 6 mm or more occurs, submit recommendation for providing a smooth transition; to Consultant for review.
- .9 Patch or replace portions of existing surfaces which are damaged, lifted, discoloured, or showing other imperfections.
- .10 Finish surfaces as specified in individual Product sections.

1.2 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Record Documentation: Accurately record actual locations of subsurface obstructions and capped utilities.

1.3 SITE CONDITIONS

- .1 Conduct demolition to minimize interference with adjacent and occupied building areas.
- .2 Cease operations immediately if structure appears to be in danger and notify Consultant. Do not resume operations until directed.

Part 2 Products

2.1 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to applicable code for demolition work, dust control, products requiring electrical reconnection.
 - .2 Obtain required permits from authorities.
 - .3 Do not close or obstruct egress width to any building or site exit.
 - .4 Do not disable or disrupt building fire or life safety systems without three (3) days prior written notice to Owner.
 - .5 Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

2.2 MATERIALS

- .1 Not Used.

Part 3 Execution

3.1 PREPARATION

- .1 Provide, erect, and maintain temporary barriers at locations indicated.
- .2 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued Owner occupancy.
- .3 Protect existing materials which are not to be demolished.
- .4 Prevent movement of structure; provide bracing and shoring.
- .5 Notify affected utility companies before starting work and comply with their requirements.
- .6 Mark location and termination of utilities.
- .7 Provide appropriate temporary signage including signage for exit or building egress.

3.2 DEMOLITION

- .1 Disconnect cap designated utilities within demolition areas.
- .2 Demolish in an orderly and careful manner. Protect existing supporting structural members.
- .3 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- .4 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- .5 Remove temporary Work.

END OF SECTION

SECTION 03 11 00 CONCRETE FORMING

Part 1 General

1.1 SECTION INCLUDES

- .1 Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- .2 Openings in forms for other work.
- .3 Form accessories.
- .4 Form stripping.
- .5 Exposed concrete to be formed using an architectural form liner.

1.2 REFERENCE STANDARDS

- .1 REP 301-20 Specifications for concrete construction (SI units)
- .2 ASME A17.1/CSA B44 - Safety Code for Elevators and Escalators.
- .3 STD S269.1-16 Falsework and formwork
- .4 STD S269.1-16 Falsework and formwork
- .5 CSA A23.1:19/A23.2:19 Concrete materials and methods of concrete construction/test methods and standard practices for concrete
- .6 STD O121-17 Douglas fir plywood
- .7 STD O151-17 Canadian softwood plywood
- .8 CSA O153:19 Poplar plywood
- .9 STD O437 SERIES-93 Standards on OSB and waferboard (Withdrawn)
- .10 Exterior plywood for concrete formwork (Withdrawn)

1.3 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data on void form materials and installation requirements.
- .3 Shop Drawings:
 - .1 Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
 - .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.

1.4 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Deliver void forms and installation instructions in manufacturer's packaging.
- .3 Store off ground in ventilated and protected manner to prevent deterioration from moisture.

Part 2 Products

2.1 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to applicable code for design, fabrication, erection and removal of formwork.

2.2 PERFORMANCE / DESIGN CRITERIA

- .1 Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.
- .2 Conform to CSA-S269.1.

2.3 WOOD FORM MATERIALS

- .1 Form Materials: At the discretion of the Contractor.
- .2 Softwood Plywood: CSA-O151, C Grade, Group 2.
- .3 Plywood: COFI Exterior Plywood for Concrete Formwork species; sheathing grade; sound undamaged sheets with clean, true edges.

2.4 FORMWORK ACCESSORIES

- .1 Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify lines, levels and centres before proceeding with formwork.
- .3 Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

- .1 Earth forms are not permitted.

3.3 ERECTION - FORMWORK

- .1 Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of CAN/CSA-S269.3.
- .2 Fabricate and erect false work in accordance with CSA-S269.1.
- .3 Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- .4 Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- .5 Align joints and make watertight. Keep form joints to a minimum.
- .6 Obtain approval before framing openings in structural members which are not indicated on Drawings.
- .7 Coordinate this section with other sections of work which require attachment of components to formwork.
- .8 If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Consultant.

3.4 APPLICATION - FORM RELEASE AGENT

- .1 Apply form release agent on formwork in accordance with manufacturer's recommendations.
- .2 Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- .1 Provide formed openings where required for items to be embedded in passing through concrete work.
- .2 Locate and set in place items that will be cast directly into concrete.
- .3 Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- .4 Position recessed reglets for brick veneer masonry anchors to spacing and intervals specified in Section 04 27 13.
- .5 Install accessories in accordance with manufacturer's written instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- .6 Install waterstops to manufacturer's written instructions continuous without displacing reinforcement. Heat seal joints watertight.
- .7 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- .8 Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

- .1 Clean forms as erection proceeds, to remove foreign matter within forms.
- .2 Clean formed cavities of debris prior to placing concrete.
- .3 Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- .4 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

- .1 Construct formwork to maintain tolerances in accordance with CSA-A23.1/A23.2.
- .2 Construct and align formwork for elevator hoistway in accordance with ASME A17.1/CSA-B44.
- .3 Camber slabs and beams 2 mm per m.
- .4 Camber slabs and beams in accordance with ACI 301.

3.8 FORM REMOVAL

- .1 Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- .2 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- .3 Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 03 20 00 CONCRETE REINFORCING

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ASTM A1064/A1064M-18a - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .2 ASTM A123/A123M-17 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A184/A184M-19 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- .4 ASTM A1064/A1064M-18a - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .5 ASTM A416/A416M-18 - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
- .6 ASTM A1064/A1064M-18a - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .7 ASTM A1064/A1064M-18a - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .8 ASTM A704/A704M-19e1 - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
- .9 ASTM A775/A775M-19 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
- .10 ASTM D3963/D3963M-15 - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
- .11 CSA-A23.1-19/A23.2-19 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .12 CSA-A23.3-19 - Design of Concrete Structures.
- .13 CSA-G30.18-09 (R2014) - Carbon Steel Bars for Concrete Reinforcement.
- .14 CSA-G40.20-13/G40.21-13 (R2018) - General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
- .15 CSA-S806-12 (R2017) - Design and Construction of Building Structures with Fibre-Reinforced Polymers.
- .16 CSA-W186-M1990 (R2016) - Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .17 RSIC (Reinforcing Steel Institute of Canada) – Manual of Standard Practice.

1.2 ACTION SUBMITTALS

- .1 Section 01 33 00: Procedures for submittals.
- .2 Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, supporting and spacing devices.
- .3 Product Data: Provide data on joint devices, attachment accessories, admixtures.

1.3 QUALITY ASSURANCE

- .1 Perform Work in accordance with one (1) copy. Maintain CSA-A23.1/A23.2 of document on site.
- .2 Provide Consultant with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

- .3 Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.
- .4 Welders' Certificates: Submit to Section 01 43 00, Manufacturer's Certificates, certifying welders employed on the Work, verifying CSA-qualification within the previous 12 months.

Part 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 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A497/A497M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A497/A497M.
- .6 Welded steel wire fabric: to ASTM A185/A185M.
- .7 Welded deformed steel wire fabric: to ASTM A497/A497M.
- .8 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .9 Mechanical splices: subject to approval of Consultant.
- .10 Plain round bars: to CSA-G40.20/G40.21.

Part 3 Execution

3.1 PLACEMENT

- .1 Place, support and secure reinforcement against displacement to CSA-A23.1/A23.2 and as indicated on reviewed placing Drawings.
- .2 Do not displace or damage vapour barrier.
- .3 Accommodate placement of formed openings.
- .4 Maintain concrete cover around reinforcing.
- .5 Conform to applicable code for concrete cover over reinforcement.
- .6 Bond and ground all reinforcement to requirements of Section 26 05 26.

END OF SECTION

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

Part 1 General

1.1 REFERENCE STANDARDS

- .1 ACI 305R-10 - Guide to Hot Weather Concreting.
- .2 ACI 306R-16 - Guide to Cold Weather Concreting.
- .3 ASTM A820/A820M-16 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.
- .4 ASTM B221-14 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .5 ASTM B221M-13 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .6 ASTM C260/C260M-10a(2016) - Standard Specification for Air-Entraining Admixtures for Concrete.
- .7 ASTM C330/C330M-17a - Standard Specification for Lightweight Aggregates for Structural Concrete.
- .8 ASTM C494/C494M-19 - Standard Specification for Chemical Admixtures for Concrete.
- .9 ASTM C1017/C1017M-13e1 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .10 ASTM D412-16 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
- .11 ASTM D624-00(2020) - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- .12 ASTM D994/D994M-11(2016) - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- .13 ASTM D1751-18 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .14 ASTM D1752-18 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .15 CSA-A23.1-19/A23.2-19 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .16 CSA-A3000-18 - Cementitious Materials Compendium.

1.2 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data on joint devices, attachment accessories, admixtures.
- .3 Test Data: Minimum four (4) weeks prior to starting concrete work, submit manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Blended hydraulic cement.
 - .3 Portland-limestone cement.
 - .4 Supplementary cementing materials.
 - .5 Grout.
 - .6 Admixtures.

- .7 Aggregates.
- .8 Water.
- .4 Certification: Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1/A23.2.
- .5 Certification: Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1/A23.2.
- .6 Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent Work.

1.3 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.4 QUALITY ASSURANCE

- .1 Perform Work in accordance with CSA-A23.1/A23.2.
- .2 Maintain one (1) copy of document on site.
- .3 Acquire cement and aggregate from same source for all work.
- .4 Conform to CSA-A23.1/A23.2 when concreting during hot weather.
- .5 Conform to CSA-A23.1/A23.2 when concreting during cold weather.

Part 2 Products

2.1 CONCRETE MATERIALS

- .1 Hydraulic Cement: CSA-A3000, Type GU; Grey colour.
- .2 Blended Hydraulic Cement: CSA-A3000, Type GUb; Grey colour.
- .3 Supplementary Cementing Materials: CSA-A3000, Fly Ash, Type F.
- .4 Aggregates: to CAN/CSA-A23.1/A23.2.
- .5 Water: CSA-A23.1/A23.2, clean and not detrimental to concrete.

2.2 ADMIXTURES

- .1 Air Entrainment: ASTM C260/C260M.
- .2 Chemical admixture: to ASTM C494 and ASTM C101. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .3 Fibre Reinforcement:
 - .1 Synthetic fibres meeting requirements of ASTM C1116/C1116M, Type III.

2.3 CONCRETE MIX

- .1 Performance Method for specifying concrete: to meet Consultant performance criteria in accordance with CAN/CSA-A23.1/A23.2

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify all dimensions and locations required on drawings.
- .3 Verify requirements for concrete cover over reinforcement.
- .4 Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not impede concrete placement.

3.2 PREPARATION

- .1 Prepare previously placed concrete and apply bonding agent to manufacturer's written instructions.

3.3 PLACING CONCRETE

- .1 Place concrete in accordance with CSA-A23.1/A23.2.

3.4 CURING AND PROTECTION

- .1 Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical damage.
- .2 Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- .3 Cure concrete floor surfaces to requirements of Section 03 39 00.
- .4 Cure floor surfaces in accordance with CSA-A23.1/A23.2.
- .5 Ponding: Maintain 100% coverage of water over floor slab areas continuously for four (4) days.
- .6 Spraying: Spray water over floor slab areas and maintain wet cure for seven (7) days.

3.5 DEFECTIVE CONCRETE

- .1 Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- .2 Repair or replacement of defective concrete will be determined by the Consultant.
- .3 Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Consultant for each individual area.

END OF SECTION

SECTION 31 05 16 AGGREGATES FOR EARTHWORK

Part 1 General

1.1 REFERENCE STANDARDS

- .1 AASHTO M 147 (2017) - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.
- .2 AASHTO T 180-17 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
- .3 ASTM C136/A136M-19 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
- .5 ASTM D1557-12e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- .6 ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- .7 ASTM D2487-17e1 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- .8 ASTM D4318-17e1 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.2 QUALITY ASSURANCE

- .1 Perform Work in accordance with Province of British Columbia standards. Maintain one (1) of document on site.

Part 2 Products

2.1 COARSE AGGREGATE MATERIALS

- .1 Coarse Aggregate Type (Gravel): Coarse Stone: Pit run, natural stone; free of shale, clay, friable material and debris; graded to ASTM C136/A136M; within the following limits:
- .2 Aggregate Type (Pea Gravel): Natural stone; washed free of clay, shale, organic matter; graded to ASTM C136/A136M; within the following limits:
 - .1 Minimum Size: 6 mm (1/4 inch).
 - .2 Maximum Size: 16 mm (5/8 inch).

Part 3 Execution

3.1 STOCKPILING

- .1 Stockpiling: No room on site to stockpile.

END OF SECTION

SECTION 32 11 23 AGGREGATE BASE COURSES

Part 1 General

1.1 REFERENCE STANDARDS

- .1 AASHTO T 180-17 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
- .2 ASTM D698-12e2 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
- .3 ASTM D1556/D1556M-15e1 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- .4 ASTM D1557-12e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- .5 ASTM D2167-15 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

Part 2 Products

2.1 MATERIALS

- .1 Coarse Aggregate Fill Type: As specified in Section 31 05 16.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

- .1 Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- .2 Do not place fill on soft, muddy, or frozen surfaces.
- .3 Excavate soft areas of subgrade, fill with 25 mm crushed gravel and compact to minimum 95% of Standard Proctor Density.

3.3 AGGREGATE PLACEMENT

- .1 Place aggregate in maximum 100 mm layers and roller compact to specified density.
- .2 Level and contour surfaces to elevations and gradients indicated.
- .3 Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- .4 Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- .5 Use mechanical tamping equipment in areas inaccessible to compaction equipment.

END OF SECTION

SECTION 32 31 13 CHAIN LINK FENCES AND GATES

Part 1 General

1.1 SECTION INCLUDES

- .1 Fence framework, fabric, and accessories.
- .2 Excavation for post bases; concrete foundation for posts.
- .3 Manual gates and related hardware.

1.2 RELATED REQUIREMENTS

- .1 Section 03 30 00 - Cast-in-Place Concrete: Concrete anchorage for posts.

1.3 REFERENCE STANDARDS

- .1 ASTM A116-11(2016) - Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric.
- .2 ASTM A121-19 - Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
- .3 ASTM A123/A123M-17 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .4 ASTM A153/A153M-16a - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .5 ASTM A392-11a(2017) - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
- .6 ASTM A428/A428M-10(2019) - Standard Test Method for Weight (Mass) of Coating on Aluminum-Coated Iron or Steel Articles.
- .7 ASTM A491-11(2017) - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
- .8 ASTM A1011/A1011M-18a - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- .9 ASTM C94/C94M-20 - Standard Specification for Ready-Mixed Concrete.
- .10 ASTM F567-14a(2019) - Standard Practice for Installation of Chain-Link Fence.
- .11 ASTM F668-17 - Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
- .12 ASTM F1043-18 - Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework.
- .13 ASTM F1083-18 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- .14 CAN/CGSB 138.1-2019 - Fabric for Chain Link Fence.
- .15 CAN/CGSB 138.2-2019 - Steel Framework for Chain Link Fence.
- .16 CAN/CGSB 138.3-2019 - Installation of Chain Link Fence.
- .17 CAN/CGSB 138.4-2019 - Gates for Chain Link Fence.
- .18 CSA-A23.1-19/A23.2-19 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .19 CLFMI (Chain Link Fence Manufacturers Institute) - Product Manual.

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- .3 Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

1.5 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Record Documentation: Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.6 QUALITY ASSURANCE

- .1 Perform Work in accordance with manufacturer's written instructions.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

Part 2 Products

2.1 DESCRIPTION

- .1 System Description:
 - .1 Fence Height: To match existing - 8'-0" high, with inward support arms with 3 strands of barbed wire on top.
 - .2 Line Post Spacing: At intervals not exceeding 3 metre.
 - .3 Fence Post and Rail Strength: Conform to ASTM F1043, Light Industrial Fence quality.

2.2 MATERIALS AND COMPONENTS

- .1 Materials and Components: Conform to CLFMI Manual.
- .2 Fabric Size: Standard Industrial service.
- .3 Intermediate Posts: Type II round.
- .4 Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

2.3 MATERIALS

- .1 Framing (Steel): CAN/CGSB 138.2, Schedule 40 galvanized steel pipe, welded construction, minimum yield strength of 172 MPa; coating conforming to ASTM F1043, Type A on pipe exterior and interior.
- .2 Fabric Wire (Steel): ASTM A491 aluminum coated wire fabric.
- .3 Concrete Piles:
 - .1 Concrete mixes and materials: in accordance with CSA A23.1 and Section 03 30 00-Cast-in-Place Concrete.
 - .2 Compressive strength: 30 MPa minimum at 28 days.
 - .3 Air-entrainment: 5-7%.
 - .4 Provide reinforcing steel as indicated on drawings.

2.4 COMPONENTS

- .1 Line Posts: 60 mm diameter.
- .2 Corner and Terminal Posts: 89 mm.
- .3 Top and Middle Brace Rail: 42 mm diameter, plain end, sleeve coupled.
- .4 Fabric: 51 mm diamond mesh interwoven wire, 6 mm thick, top salvage twisted tight bottom salvage knuckle end closed.
- .5 Tension Wire: 5 mm thick steel, single strand.
- .6 Tie Wire: Aluminum alloy steel wire.

2.5 ACCESSORIES

- .1 Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- .2 Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

2.6 FINISHES

- .1 Components and Fabric: Galvanized to ASTM A123/A123M, coating thickness appropriate grade for type and size of steel material indicated.
- .2 Hardware: Galvanized to ASTM A153/A153M, 550 g/sq m coating.
- .3 Accessories: Same finish as framing.

Part 3 Execution

3.1 INSTALLATION

- .1 Install framework, fabric, and accessories to manufacturer's written instructions.
- .2 Place fabric on outside of posts and rails.
- .3 Set corner, terminal, intermediate, and gate posts plumb, in concrete footings with top of footing 50 mm above, 600 mm below finish grade. Slope top of concrete for water runoff.
- .4 Do not stretch fabric until concrete foundation has cured twenty-eight (28) days.
- .5 Stretch fabric between terminal posts or at intervals of 30 m maximum, whichever is less.
- .6 Position bottom of fabric 50 mm above finished grade.
- .7 Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 380 mm on centres.
- .8 Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- .9 Install bottom tension wire stretched taut between terminal posts.
- .10 Install support arms sloped inward and attach barbed wire; tension and secure.

3.2 CONCRETE PILES

- .1 Perform concrete work in accordance with CSA A23.1.

3.3 ERECTION TOLERANCES

- .1 Section 01 73 00: Tolerances.
- .2 Maximum Variation From Plumb: 6 mm.
- .3 Maximum Offset From True Position: 25 mm.
- .4 Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 32 92 19 SEEDING

Part 1 General

1.1 DEFINITIONS

- .1 Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

Part 2 Products

2.1 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Comply with regulatory agencies for fertilizer composition.
 - .2 Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

2.2 SEED MIXTURE

- .1 Seed Mixture: lawns in dry and shaded areas with minimal watering requirements.
 - .1 35% Kentucky bluegrass blend,
40% Creeping red fescue blend,
15% Chewing red fescue,
10% Perennial ryegrass blend.

2.3 SOIL MATERIALS

- .1 Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

2.4 ACCESSORIES

- .1 Fertilizer: Type recommended for soil and grass, with 50% of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil as indicated in analysis.
- .2 Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.
- .3 Erosion Fabric:
 - .1 Woven coconut fibre (coir) twine, 100% biodegradable erosion control matting.
- .4 Stakes: Softwood lumber, chisel pointed.
- .5 String: Inorganic fibre.
- .6 Edging: Plastic.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify that prepared soil base is ready to receive the work of this section.

3.2 PREPARATION OF SUBSOIL

- .1 Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- .2 Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
- .3 Scarify subsoil to a depth of 75 mm (3 inches) where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

- .1 Spread topsoil to a minimum depth of 100 mm (4 inches) over area to be seeded. Rake until smooth.
- .2 Place topsoil during dry weather and on dry unfrozen subgrade.
- .3 Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- .4 Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- .5 Install edging at periphery of seeded areas in straight lines to consistent depth.
- .6 Coordinate with installation of underground sprinkler system piping and watering heads.

3.4 FERTILIZING

- .1 Apply fertilizer at rate recommended by manufacturer.
- .2 Apply after smooth raking of topsoil and prior to roller compaction.
- .3 Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- .4 Mix thoroughly into upper 50 mm (2 inches) of topsoil.
- .5 Lightly water to aid the dissipation of fertilizer.

3.5 SEEDING

- .1 Apply seed evenly in two intersecting directions. Rake in lightly.
- .2 Do not seed areas in excess of that which can be mulched on same day.
- .3 Planting Season: April to September.
- .4 Do not sow immediately following rain, when ground is too dry, or during windy periods.
- .5 Roll seeded area with roller not exceeding 50 kg (112 lbs).
- .6 Immediately following seeding and compacting, apply mulch to a thickness of 3 mm (1/8 inch). Maintain clear of shrubs and trees.
- .7 Apply water with a fine spray immediately after each area has been mulched. Saturate to 100 mm (4 inches) of soil.

3.6 PROTECTION OF SEEDED AREAS - GENERAL

- .1 Contractor shall provide adequate protection to protect seeded areas from all damage, disturbance, or other construction activity after seeding operations are complete. Remove protection after seed areas are properly established or as directed by Owner.
 - .1 Protection to be snow guard - lower traffic or risk areas.
 - .2 Protection to be temporary metal fence - higher traffic areas like schools.
- .2 Damaged seed areas resulting from inadequate protection shall be promptly repaired with topsoil, fertilizer and seed at Contractor's expense.

END OF SECTION

SECTION 50 00 00
SCHEDULE A - MECHANICAL SPECIFICATIONS

Part 1 General

1.1 MECHANICAL SPECIFICATION

- .1 Refer attached Western Financial Place Evaporative Condenser Replacement Mechanical Specification, 68 pages, prepared by Polar Engineering.
- .1 Division 00 and 01 overrides Mechanical Specification Part 1 Contractor Deliverables and Part 2 General Work Instructions where information contradicts.

Part 2 Products - Not Used

Part 3 Execution - Not Used

END OF SECTION

Western Financial Place Evaporative Condenser Replacement Mechanical Specifications



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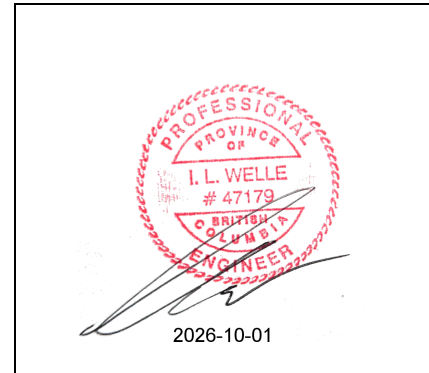
2026-09-24

Date

Engineer of Record



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EGBC Permit to Practice
#1003657

Revision Log

VERSION	DATE	AFFECTED SECTIONS	CHANGE REQUEST #	COMMENTS	CHANGE AUTHOR

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PART 1 CONTRACTOR DELIVERABLES

1.1 DEFINITIONS

- 1.1.1 The following are definitions of words found in this specification document and associated drawings and documents:
- Provide (and tenses of provide) means supply and install complete
 - Install (and tenses of install) means install and connect complete
 - Supply (and tenses of supply) means supply only
 - Specified (and tenses of specified) includes instructions and information in this specification document and associated documents and drawings
 - Owner means City of Cranbrook
 - Consultant means Polar Engineering who has prepared the contract documents on behalf of the Owner

1.2 SHOP DRAWINGS

- 1.2.1.1 Submit for review, shop drawings and product data sheets indicating in detail the design, construction, and performance of products and components. Shop drawings and product data sheets shall be supplied as PDF (Portable Document Format) files.
- 1.2.1.2 Allow enough time for submittal review, including resubmittals. Time for review shall commence on receipt of submittal by the Consultant. Extension of the Contract Schedule will not be authorized due to failure by the Contractor to transmit submittals in advance of the Work to permit processing, including resubmittals.
- 1.2.1.2.1 Initial Review: Allow 10 working days for initial review of each submittal. Additional time may be required for coordination with subsequent submittals or Subconsultants.
- 1.2.1.2.2 Resubmittal Review: Allow 5 working days for review of each resubmittal.
- 1.2.1.3 Shop drawings shall include equipment performance data, piping, power, and control wiring schematics, included accessories, rated capacities, weights, and all other relevant data.
- 1.2.1.4 The Contractor must obtain shop drawings approved by the Consultant prior to ordering equipment.
- 1.2.1.5 All pressure vessels must be certified and registered with the appropriate governing body.

- 1.2.1.6 Product alternates or substitutes which meet the same design criteria as explicitly or implicitly described in the design and tender documents must be submitted two weeks prior to the closing date of the tender for approval by the Consultant.
- 1.2.1.7 Submittals shall include the following information where applicable:
- Manufacturer
 - Surface area and heat transfer area
 - Refrigerant inlet/outlet temperatures
 - Fluid inlet/outlet temperatures
 - Operating pressures
 - Pressure drops
 - Manufacturing material
 - Pressure ratings
 - CRN numbers
 - Voltage and phase
 - RPM
 - Seals and gaskets
 - Construction materials
- 1.2.1.8 Contractor shall provide the following submittals to the Consultant and Owner's Representative:
- 1.2.1.8.1 Equipment shop drawings and product data sheets, complete with piping and power and control wiring schematics, accessories, rated capacities, weights, and all other relevant data.
- 1.2.1.8.2 Factory inspections and test reports with O & M Manual project close-out data.
- 1.2.1.8.3 Site inspection and start-up report detailing all the important equipment functions required to ensure equipment performance over the entire range of operation.
- 1.2.1.8.4 A one-year written warranty for all workmanship dated and signed by the Contractor.

1.3 STARTUP / COMMISSIONING / BALANCING REPORTS

- 1.3.1.1 After successful start-up and prior to Substantial Performance, commission the mechanical work in accordance with requirements of CSA Z320, Building Commissioning. Use commissioning sheets included with the CSA Standard, and any supplemental commissioning sheets required.

- 1.3.1.2 The following equipment types each require submittal of a Startup or Commissioning or Balancing Report complete with temperature readings, pressure readings, speed or position settings, and flowrates:
 - 1.3.1.2.1 Pumps (pressure, speed, rpm, flow)
- 1.3.1.3 Submit final commissioning data sheets, project closeout documents, and other required submittals to the Consultant and Owner's Representative. Ignore items that do not pertain to this project. These submittals will include, but are not limited to:
 - 1.3.1.3.1 Inspection Date
 - 1.3.1.3.2 Inspection or test personnel.
 - 1.3.1.3.3 Description of testing procedure
 - 1.3.1.3.4 VFD speed and current of all pumps
 - 1.3.1.3.5 Pump pressure differentials
 - 1.3.1.3.6 VFD speed and current of all fans
 - 1.3.1.3.7 Evaporative condenser condensing pressure and temperature, and spray pump discharge pressure
 - 1.3.1.3.8 Ammonia high cut out testing
 - 1.3.1.3.9 Ammonia liquid level normal operating percentages
 - 1.3.1.3.10 Control system testing and verification
 - 1.3.1.3.11 All other relevant information that may impact the performance of the system.
- 1.3.1.4 Furthermore, the following operating conditions shall be simulated, and the operation of the controls system checked to ensure a fully functional system.
 - 1.3.1.4.1 All other operating conditions required to confirm the intended operation and performance of the system.
 - 1.3.1.4.2 Please refer to control strategies contained within the attached drawing package for more information.
- 1.3.1.5 During each one of these situations, the following conditions shall be recorded and provided to the Consultant and Owner's Representative. It is the responsibility of all contractors to work together to ensure proper commissioning, but it is the responsibility of the Contractor to provide the Owner and the Consultant with the documentation below:
 - 1.3.1.5.1 Speed and pressure differential of all pumps

- 1.3.1.5.2 All other relevant information required to evaluate the performance of the system.
- 1.3.1.6 Final balancing and commissioning reports to be included in the O&M manual.

1.4 AS-BUILT OR RECORD DRAWINGS

- 1.4.1.1 One printed copy of the latest tender or construction drawings shall be kept onsite during construction to allow for red-line markup of detail changes.
- 1.4.1.2 Contractor must deliver in hardcopy (size Arch D), PDF, and AutoCAD (.dwg) formats a digitally created As-Built drawing set to the Owner at project closeout, pending Consultant review and approval.
- 1.4.1.3 Alternatively, the Contractor may deliver a red-line markup version of construction documents for the Engineer (Polar) to create Record Drawings from.
- 1.4.1.4 Polar charges \$500 per drawing set for this work.

1.5 OPERATION & MAINTENANCE MANUALS

- 1.5.1.1 Prior to application for Substantial Completion, submit all required items and documentation specified, including the following:
 - 1.5.1.1.1 Operating and Maintenance Manuals
 - 1.5.1.1.2 Final commissioning report
- 1.5.1.2 Operation and Maintenance Manuals must be provided in the following formats:
 - 1.5.1.2.1 Submit 2 hard copies consolidated in hardcover D-ring binders
 - 1.5.1.2.2 Submit 1 digital copy on a USB flash drive to facility staff
 - 1.5.1.2.3 Submit 1 digital copy to the Owner's Representative
- 1.5.1.3 Maintenance manuals shall include:
 - 1.5.1.3.1 The Consultant's name, street address, telephone number, and email address
 - 1.5.1.3.2 The Contractor's name, street address, telephone number, and email address
 - 1.5.1.3.3 All subcontractors' names, street address, telephone number, and email address
 - 1.5.1.3.4 A copy of each "Reviewed" shop drawing or product data sheet

- 1.5.1.3.5 Each shop drawing shall include the manufacturer or supplier name, telephone number, and email address.
- 1.5.1.3.6 Each shop drawing shall include the email address for local source of parts and service.
- 1.5.1.4 Maintenance manuals shall include recommended maintenance and maintenance intervals, normal operating parameters, data sheets, and the expected lifespan of all mechanical, electrical, and controls equipment.

1.6 DEMONSTRATION & TRAINING

- 1.6.1.1 Provide training to the Owner's designated personnel in all aspects of operation and maintenance of the equipment after start-up.
- 1.6.1.2 All demonstrations and training shall be performed by qualified technicians employed by the equipment/system manufacturer/supplier.
- 1.6.1.3 The Contractor shall provide a onetime onsite training course which will include the following:
 - 1.6.1.4 Coordinate with all subcontractors to ensure that training encompasses all relevant systems.
 - 1.6.1.5 Record date of training and name and signature of all attendees
- 1.6.1.6 The Contractor shall provide a syllabus of the training session to the Owner and Consultant for approval before scheduling the training session.
- 1.6.1.7 Training for Facility Operations Staff shall cover the following subjects:
 - 1.6.1.7.1 Regular and seasonal preventative maintenance procedures
 - 1.6.1.7.2 Sequence of operations
 - 1.6.1.7.3 Desired operating temperature/pressure ranges of equipment
 - 1.6.1.7.4 Safety controls
 - 1.6.1.7.5 Emergency isolation valves
 - 1.6.1.7.6 Alarms
 - 1.6.1.7.7 Proper use of computer control system
 - 1.6.1.7.8 Trouble-shooting procedures
 - 1.6.1.7.9 Primary & secondary pressure relief systems and overflows
 - 1.6.1.7.10 All other relevant system information required for safe and efficient operation of the system.
- 1.6.1.8 Training for facility electricians shall cover the following subjects:
 - 1.6.1.8.1 All electrical systems

- 1.6.1.8.2 Sequence of operations
- 1.6.1.8.3 Safety controls

END OF SECTION

PART 2 GENERAL WORK INSTRUCTIONS

2.1 GENERAL

2.1.1 REFERENCES

- 2.1.1.1 The General Conditions of the Contract, the Supplementary Conditions, and all Sections of Division 01 apply to and are a part of this Section of the Specification.

2.1.2 APPLICATION

- 2.1.2.1 This Section specifies requirements and instructions that are common to the Sections of the Specification. It is a supplement to each Section and is to be read accordingly.

2.1.3 CODES, REGULATIONS, AND STANDARDS

- 2.1.3.1 All Codes, Regulations, and Standards referred to in this Section and in Sections to which this Section applies are the latest edition of the Codes, Regulations, and Standards in effect at the time the building permit is obtained, or at the time of bid closing for the Project, whichever comes first.
- 2.1.3.2 All work is to be in accordance with requirements with Codes, Regulations, and Standards applied by governing authorities, including:
- 2.1.3.2.1 The BC Building Code
 - 2.1.3.2.2 Technical Safety BC (TSBC)
- 2.1.3.3 All electrical items associated with mechanical equipment are to be certified and bear the stamp or seal of a recognized testing agency such as CSA, UL, ULC, or ETL; or bear a stamp to indicate special electrical utility approval.
- 2.1.3.4 All work must be completed in a manner that allows the Owner to maintain a TSBC Risk Assessed status.

2.1.4 QUALITY ASSURANCE

- 2.1.4.1 All work is to be done by tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on-site supervision of an experienced Industrial Training Authority Red Seal certified journeyman tradesman.
- 2.1.4.2 Testing and inspections not explicitly assigned to the Owner are the Contractor's responsibility. Unless otherwise indicated, provide the quality

control, testing, and commissioning services specified in this document and those required by municipal, provincial, and federal governing bodies.

2.1.4.3 All quality control services must be provided by qualified personnel or testing agency.

2.1.4.4 All quality control services must be recorded, and documentation submitted to the Owner and the Consultant for verification and approval.

2.1.4.5 All contractors and subcontractors shall identify a qualified red seal tradesman or other qualified owner representative as the main point of contact for the Consultant and the Owner.

2.1.4.6 All welders must be Class B or A and have up to date documentation.

2.1.5 COMBUSTIBLE PIPING MATERIALS

2.1.5.1 Combustible piping, tubing and associated adhesives are permitted to be used in a building required to be of non-combustible construction provided that, except when concealed in a wall or concrete floor slab, they have a flame-spread rating not more than 25, and if used in a plenum space or "high-building" (as defined by the BC Building Code), have a smoke developed classification not more than 50, in accordance with ULC-S102.2 testing standards.

2.1.6 SEISMIC RESTRAINT SYSTEMS

2.1.6.1 Supply and install seismic restraints for all piping and ductwork systems and all equipment specified in the refrigeration, HVAC, and plumbing sections of this specification in accordance with the British Columbia Building Code.

2.1.6.2 Arrange and pay for the services of a structural supporting professional engineer registered in the province of British Columbia (Seismic Engineer) to design and certify the seismic restraints for all refrigeration, HVAC, and plumbing systems in accordance with the British Columbia Building Code. The Seismic Engineer shall provide direction to the Contractor during installation of the seismic restraints systems and submit signed and sealed Schedules S-B and S-C for the project.

2.1.6.3 Supply and install restraint on all piping, ductwork, equipment and machinery, which is part of the refrigeration, HVAC, and plumbing systems to prevent injury or hazard to persons and equipment and to retain equipment in its normal position in the event of an earthquake.

- 2.1.6.4 Supply and install all seismic restraint related hardware, (including bolts and anchors) from point of attachment to equipment through to and including attachment to structure.
- 2.1.6.5 When equipment is mounted on concrete housekeeping pads, and/or concrete curbs the anchor bolts shall extend through the pad into the structure.
- 2.1.6.6 Structural integrity of packaged equipment and its internal components is the responsibility of the equipment manufacturer.
- 2.1.6.7 Seismic restraints may only be omitted where not required by SMACNA Guidelines.

2.1.7 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

- 2.1.7.1 All professional engineers retained by the Contractor to perform consulting services with regard to the work, for example, Seismic Engineer, are to be members in good standing with the local Association of Professional Engineers and are to carry and pay for errors and omissions for professional liability insurance in compliance with requirements of the governing authorities in the locale of the work.
- 2.1.7.2 The retained engineer's professional liability insurance is to protect the Contractor's consultants and sub-consultants, their respective servants, agents, and employees against any loss or damage resulting from the professional services rendered by the Contractor's consultants and sub-consultants, their respective servants, agents, and employees regarding the work of this Contract.
- 2.1.7.3 The Contractor is to meet or exceed all liability insurance requirements laid out in the Owner's contract documentation.
- 2.1.7.4 If the Owner's contract documentation does not contain specific liability insurance requirements, the following requirements are to be met at a minimum:
 - 2.1.7.4.1 Coverage is to be a minimum of \$2,000,000.00 inclusive of any one occurrence
 - 2.1.7.4.2 The insurance policy is not to be cancelled or changed in any way without the insurer giving the Owner a minimum of thirty days written notice
 - 2.1.7.4.3 Liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the location of the work

- 2.1.7.5 Evidence of the required liability insurance in such form as may be required shall be submitted to the Owner, the Owner's consultant, and Authorities Having Jurisdiction as required prior to commencement of the Contractor's sub-consultant services.

2.1.8 EXAMINATION OF SITE AND DOCUMENTS

- 2.1.8.1 When estimating the cost of the work and prior to submitting a bid for the work, carefully examine all the bid documents and visit the site to determine and review all existing site conditions that will or may affect the work and include for all such conditions in the bid price.
- 2.1.8.2 All freight costs for the equipment and materials related to installation and integration are to be included in the Contractor's bid price.
- 2.1.8.3 Contractors are to note that premium or special freight costs may be required to deliver materials to site to meet completion schedules, the cost will be borne by the Contractor.
- 2.1.8.4 Contractors are responsible for checking all the relevant dimensions and line routing before bidding.
- 2.1.8.5 Contractors are responsible for confirming available supply voltage onsite, prior to ordering of equipment.

2.1.9 DRAWINGS AND SPECIFICATION

- 2.1.9.1 The mechanical drawings show approximate locations of equipment and connecting services. Any information regarding accurate measurements of the building are to be taken at the site by the Contractor.
- 2.1.9.2 As-built drawings shall be kept onsite during construction to allow for identification of design changes as part of the construction process.
- 2.1.9.3 A marked-up set of the drawings shall either be submitted to the Consultant for update, paid for by the Contractor, or a complete set of updated drawings will be submitted for approval by the Consultant and the Owner.
- 2.1.9.4 Drawings must be supplied to the Owner upon project completion, in each of the following formats:
- Hardcopy in size Arch D
 - PDF
 - AutoCAD (.dwg)
- 2.1.9.5 Submit a digital copy of all as-built drawings to the Owner's Representative.

2.1.10 PERMITS AND FEES

- 2.1.10.1 Contractor is responsible for applying for, obtaining, and paying for all permits and inspection fees required to complete the work.
- 2.1.10.2 A copy of each permit and inspection report shall be provided to the Owner's Representative.
- 2.1.10.3 Design registration shall be completed and submitted by the Contractor as required by Technical Safety BC.

2.1.11 PAYMENT

- 2.1.11.1 Substantial completion will not be approved until all, but not only, of these conditions are met:
 - 2.1.11.1.1 Work is completed to a state in which it is safe to operate the equipment by the owner and spaces affected by the work are safe to be occupied by the public.
 - 2.1.11.1.2 Progress of the work is at the level of the 3/2/1 rule as defined in the Builders Lien Act for substantial completion.
 - 2.1.11.1.3 Scope of work is functionally complete to the satisfaction of the owner and the consultant.

2.1.12 SCAFFOLDING, RIGGING, AND HOISTING

- 2.1.12.1 Supply, erect and operate all scaffolding, rigging, hoisting equipment and associated hardware required to perform the work.
- 2.1.12.2 Do not place major loads on any portion of the structure without approval from the Consultant.
- 2.1.12.3 Submit for review, rigging and hoisting plans, contemplated dates, permits, equipment, safety measures, and personnel prior to hoisting operations.

2.1.13 PHASING, HOURS OF WORK, AND NOISE CONTROL

- 2.1.13.1 The Contractor shall institute appropriate controls to reduce nuisance noise level from affecting the areas adjacent to the work site.

2.1.14 EQUIPMENT AND SYSTEM START-UP

- 2.1.14.1 All equipment shall be installed and integrated with the existing systems with all the necessary piping, valves, purge points, strainers, sight glasses, sensors, drain ports, conduit, disconnects, control equipment, electrical, base, and piping supports as required to ensure a complete functioning system.
- 2.1.14.2 When installation of equipment/systems is complete prior to commissioning, perform start-up under direct on-site supervision and

involvement of the equipment/system manufacturer's representative or the Consultant, make any required adjustments, document the procedures, leave the equipment/system in proper operating condition, and submit a complete set of start-up documentation sheets signed by the manufacturer/supplier and the Contractor.

2.1.15 EQUIPMENT INSPECTIONS

- 2.1.15.1 It is the responsibility of the Contractor to make the Consultant aware of appropriate inspection dates based on work commenced onsite. The Contractor shall give the Consultant at least one week's notice inside British Columbia and two weeks' notice outside of British Columbia.
- 2.1.15.2 Upon substantial project completion, the Contractor shall contact the Consultant for a final inspection and deficiency list.
- 2.1.15.3 Upon substantial project completion, the Consultant will perform an onsite inspection and send the Contractor an inspection summary and a deficiency inspection list. All deficiencies must be addressed to the satisfaction of the Owner's Representative and Consultant before the final holdback is paid by the Owner to the Contractor.
- 2.1.15.4 The Contractor shall repair or replace all property and existing equipment that is damaged or disturbed during construction. Equipment and property repairs must be completed to the satisfaction of the Owner's Representative and the Consultant before the final holdback is paid to the Contractor.

2.1.16 SAFETY AND TRAFFIC

- 2.1.16.1 The Contractor as the Prime Contractor is responsible for all safety measures required by the Owner, municipal, provincial government, and federal government.
- 2.1.16.2 The Contractor shall provide all traffic control required by the Owner, municipal, provincial government, and federal government to effectively perform the work outlined in this document.

2.1.17 PROJECT SCHEDULE

- 2.1.17.1 Upon award of contract, the Contractor shall prepare a work schedule with all major work identified, subcontractors identified, and expected dates for consultant site inspections identified.
- 2.1.17.2 The schedule shall be submitted for review and approval by the Owner and the Consultant within 14 days of contract award.

2.1.18 PROJECT MEETINGS

- 2.1.18.1 The Contractor shall attend project meetings as called by the Owner or the prime consultant.
- 2.1.18.2 Contractor to provide a project Gantt chart to the Owner's Representative and the Consultant upon project award. This Gantt chart is to be updated monthly to reflect changes in project progress. At minimum, this Gantt chart must contain:
 - 2.1.18.2.1 Expected equipment delivery dates
 - 2.1.18.2.2 Construction schedule
 - 2.1.18.2.3 Required facility shutdowns and expected startup dates
 - 2.1.18.2.4 Expected inspection dates
 - 2.1.18.2.5 Expected project completion date
 - 2.1.18.2.6 Other information deemed important by the Owner's Representative or Consultant
- 2.1.18.3 Contractor to attend and chair additional site meetings as requested by the Owner or the Consultant.

2.1.19 REQUESTS FOR INFORMATION

- 2.1.19.1 Obtain answers to work related queries at site meetings whenever possible, but if not possible, prepare a Request for Information (RFI) and email to the Consultant. The RFI is to include:
 - 2.1.19.1.1 The Project name, the date, and Contractor's name and the name of the person making the query.
 - 2.1.19.1.2 An RFI number, a drawing reference if applicable, and a detailed description of the problem for which the RFI is issued.
- 2.1.19.2 Consultant will endeavor to provide response to RFI within ten working days of submission. RFIs received by Consultant after 1:00 p.m. will be considered as received the following working day.

2.2 PRODUCTS

2.2.1 MECHANICAL WORK IDENTIFICATION MATERIALS

- 2.2.1.1 Equipment Nameplates: Minimum 1/16" thick 2-ply laminated coloured plastic plates, minimum ½" x 2" for smaller items such as control valves, minimum 1" x 2½" for equipment, and minimum 2" x 4" for control panels and similar items. Additional requirements are as follows:

- 2.2.1.1.1 Each nameplate is to be white, complete with bevelled edges and black engraved capital letter wording to completely identify the equipment and its use with no abbreviations unless specified otherwise.
- 2.2.1.1.2 Wording is to include equipment service but must be reviewed/approved prior to engraving.
- 2.2.1.1.3 Supply stainless steel screws for securing nameplates in place.
- 2.2.1.2 Pipe Identification: Pipe identification is to be equal to Smillie McAdams Summerlin Ltd. or Brady vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:
 - 2.2.1.2.1 For pipe to and including 6" diameter, coiled type snap-on markers of a length are to wrap completely around the pipe or pipe insulation.
 - 2.2.1.2.2 For pipe larger than 6" diameter, saddle type strap-on markers with two opposite identification locations and completed with nylon cable ties.
- 2.2.1.3 Identification wording and colours are to match existing wording and colours at the site.
- 2.2.1.4 Ammonia piping, valves, and other components shall be labelled per IIAR (International Institute of Ammonia Refrigeration) recommendations.
- 2.2.1.5 Where there is no existing identification onsite, the Contractor is to confirm identification, colour, and nomenclature with the Consultant.
- 2.2.1.6 Upon project completion, Contractor to supply Owner's Representative with both PDF and size Arch D drawing detailing all valve and equipment tags.

2.3 EXECUTION

2.3.1 INSTALLATION OF EQUIPMENT

- 2.3.1.1 Unless otherwise specified or indicated, install all equipment in accordance with the equipment manufacturer's recommendations and instructions. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.
- 2.3.1.2 The Contractor is responsible for transportation, off-loading, and rigging of all mechanical equipment and materials, including all costs associated with these activities.
- 2.3.1.3 The Contractor is responsible for all premium or special freight costs required to deliver materials and equipment to site to meet construction schedules.

- 2.3.1.4 Contractor to provide piping and equipment supports, anchors, sleeves, anchor bolts, restraints, and accessories as required.
- 2.3.1.5 Contractor to provide equipment supports, structural steel frames, housekeeping pads, and mounting accessories as required.
- 2.3.1.6 The Contractor is responsible for all structural and/or seismic engineering and associated costs to ensure equipment stands meet all governing codes and standards.
- 2.3.1.7 Contractor to provide snow guards and/or snow breaks to ensure falling snow does not damage or negatively affect the performance of installed equipment.
- 2.3.1.8 All systems and pieces of equipment are to be provided with all necessary piping, valves, equalization lines, filters, purge points, drains, vents, and disconnects required to ensure reliable operation.
- 2.3.1.9 All systems and pieces of equipment to be provided with all electrical components and accessories required to integrate with onsite electrical infrastructure.
- 2.3.1.10 All systems and pieces of equipment are to be provided with all necessary mechanical, electrical, and controls equipment required to ensure reliable operation.
- 2.3.1.11 Contractor responsible for providing, charging, and installing condenser spray water treatment chemicals and any ammonia charge required to operate the system for the first 6 months.
- 2.3.1.12 Primary/secondary fluids shall only be reused with express written permission from the Owner and Consultant.
- 2.3.1.13 Contractor responsible for updating the pressure relief and safety devices associated with the new equipment to ensure compliance with governing codes and standards.
- 2.3.1.14 Contractor responsible for providing controls wiring, conduit, sensing equipment, coding, graphics, and licenses for all new/modified systems and pieces of equipment.
- 2.3.1.15 Contractor responsible for commissioning all new equipment and making any necessary adjustments to existing equipment to ensure safe and reliable operation.
- 2.3.1.16 Contractor must provide a one-year labor and material warranty (on-site) commencing from when substantial completion is granted.

- 2.3.1.17 Contractor is responsible for labeling all the equipment, piping, valves, and electrical per the specification document and accompanied drawings.

2.3.2 MECHANICAL WORK IDENTIFICATION

- 2.3.2.1 Identify all new mechanical work in accordance with existing identification standards at the site.
- 2.3.2.2 Identify new piping adjacent to each valve and at each piece of connecting equipment.
- 2.3.2.3 Provide an identification nameplate for each new piece of equipment. Secure nameplates in place with stainless steel screws unless such a practice is prohibited, in which case use epoxy cement applied to cleaned surfaces.
- 2.3.2.4 Motor Controllers and Disconnect Switches: Provide an identification nameplate for each new motor controller, and on each disconnect switch provided as part of the electrical work for equipment provided and installed by the Contractor.

2.3.3 FINISH PAINTING OF MECHANICAL WORK

- 2.3.3.1 The Contractor shall prepare all surfaces, prime, and paint all piping support steels, conduit and boxes, and the existing condenser support stand and rails.
- 2.3.3.2 Contractor is to paint all the new equipment on site to match existing building and mechanical equipment.
- 2.3.3.3 Paint type and colour shall match existing building and mechanical equipment.
- 2.3.3.4 Touch-up paint all damaged factory applied finishes on mechanical work products.
- 2.3.3.5 All surfaces must be prepared, and paint applied per manufacturer's recommendations.
- 2.3.3.6 The Contractor is responsible to ensure the surface preparation and paint application are completed by someone with at least three (3) years of experience.
- 2.3.3.7 To ensure a long life, paint and all other exterior coatings must not be applied during rain, snow, or when the relative humidity is outside the recommended manufacturers' procedures.
- 2.3.3.8 Manufacturer's minimum and maximum recommended application temperatures shall be adhered to.

- 2.3.3.9 Examine surfaces one week prior to the commencement of work. Report any condition that may affect proper application to the Owner and the Consultant.
- 2.3.3.10 Mask all required surfaces prior to commencing work.
- 2.3.3.11 Clean all surfaces per manufacturer's recommendations.
- 2.3.3.12 Uncoated steel and iron surfaces: Remove grease, weld splatter, dirt, and rust. Where scale/rust is present, remove by wire brush or sand blasting, clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime all repairs after cleaning.
- 2.3.3.13 Prime and paint prepared surface per manufacturer's recommendations.

2.3.4 PIPE LEAKAGE TESTING

- 2.3.4.1 Before new piping has been insulated, and before equipment has been connected, test all new piping for leakage as outlined in specific subsections. Submit signed and dated test report sheets to confirm proper test results.
- 2.3.4.2 Include temporary piping connections required to complete pipe leakage tests.

2.3.5 SUPPLY OF MOTOR STARTERS AND ACCESSORIES

- 2.3.5.1 Motor starters for mechanical equipment, except for starters integral with packaged equipment and starters factory installed in equipment power and control panels, will be provided as part of the electrical work.
- 2.3.5.2 Motors greater than 10hp shall be supplied with a soft starter unless supplied with a VFD.

2.3.6 WASTE MANAGEMENT AND DISPOSAL

- 2.3.6.1 Separate and recycle waste materials in accordance with requirements of Canadian Construction Association Standard Document CCA 81, A Best Practices Guide to Solid Waste Reduction.

END OF SECTION

PART 3 DEMOLITION AND REVISION WORK

3.1 GENERAL

3.1.1 APPLICATION

- 3.1.1.1 This section specifies requirements, criteria, methods, and execution for mechanical demolition work that is common to one or more mechanical work sections, and it is intended as a supplement to each section and is to be read accordingly.

3.1.2 REFERENCE STANDARD

- 3.1.2.1 Perform demolition work in accordance with requirements of CAN/CSA-S350, Code of Practice for Safety in Demolition of Structures.

3.2 EXECUTION

- 3.2.1.1 The Contractor is responsible for all demolition and revision work.
- 3.2.1.2 Estimate the scope, extent, and cost of the demolition work at the site during the bidding period and include for all such costs in the bid price.
- 3.2.1.3 Demolitions shall be coordinated with the Owner's Representative to ensure minimal downtime.
- 3.2.1.4 Decommission and remove all existing equipment and materials which have been marked for removal.
- 3.2.1.5 All removed material and equipment is the property of the Owner and shall be disposed of in conjunction with the Owner's wishes.
- 3.2.1.6 All materials and equipment approved for removal by the Owner shall be disposed of in an environmentally sustainable fashion.
- 3.2.1.7 Ensure that products and materials required for re-use are properly retained and protected.
- 3.2.1.8 Where existing valves with tags are removed, the tags shall be reused where possible.
- 3.2.1.9 Remove from the site and dispose of all existing equipment and materials which have been removed.
- 3.2.1.10 Demolitions shall be completed using a method which will ensure minimal building damage, and any damage which occurs during equipment

removal must be restored to the original condition prior to the project completion.

- 3.2.1.11 If the Contractor, during renovations / demolition, should discover asbestos (or material suspected to be asbestos) on piping, he shall immediately cease all work in that area and advise the General Contractor and Owner. The Owner shall take appropriate action to verify presence of friable asbestos and be responsible for the removal of all friable asbestos. The Contractor will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.
- 3.2.1.12 Where required, wetting agents approved by the Owner, or the Consultant shall be used for dust control.
- 3.2.1.13 All demolished material shall be quickly removed from site. All demolished material which must be stored onsite will be stored in a location approved by the Owner.
- 3.2.1.14 Appropriate bodies of water, including storm water, must be appropriately protected.

END OF SECTION

PART 4 PUMPS

4.1 GENERAL

- 4.1.1.1 Pump construction shall permit complete servicing without breaking piping or motor connections.
- 4.1.1.2 Pumps shall operate at 1,800 rpm unless specified otherwise.
- 4.1.1.3 At a minimum upon commissioning, the following values shall be recorded and provided to the Owner and the Consultant.
 - Pump suction pressure
 - Pump discharge pressure
 - Pump voltage and current
 - Pump flow rate
- 4.1.1.4 Approved pump manufacturers:
 - Armstrong
 - Grundfos
 - Taco
 - Xylem (B&G)

4.2 PRODUCTS

4.2.1 VERTICAL IN-LINE CENTRIFUGAL PUMPS

- 4.2.1.1 Suitable for a maximum working pressure of 1210 kPa [175 psig] and maximum temperature of 107°C [225°F].
- 4.2.1.2 Casing: Cast iron radially split, single stage, flanged suction and discharge connections, separate tapped openings for venting, draining and gauge connections.
- 4.2.1.3 Impeller: Stainless steel
- 4.2.1.4 Shaft: Stainless steel on split coupled pumps and carbon steel with bronze sleeve on close coupled pumps.
- 4.2.1.5 Seal Assembly: Inside unbalanced mechanical seal with factory installed seal flushing line.
- 4.2.1.6 Coupling: Close coupled on motors less than 7-1/2 HP and split couplers for all motors 7-1/2 HP and larger to permit removal of seal without disturbing the motor.
- 4.2.1.7 Motor: EEMAC Class B, squirrel cage induction, continuous duty, drip proof, ball bearings.

- 4.2.1.8 Accessories: Strainer/suction guide, combination check/balance valve where scheduled.
- 4.2.1.9 Refer to equipment schedule on drawings.

4.3 EXECUTION

- 4.3.1.1 Ensure that pumps are installed such that no piping or equipment loads are imposed on the pump body. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.
- 4.3.1.2 All pumps to be installed with isolation valves, drain valves, pressure gauges on the inlet and outlet, and pressure gauges across strainers where installed.
- 4.3.1.3 All pumps to be supplied with appropriate suction guide and/or triple-duty valves to ensure a complete and functioning system.
- 4.3.1.4 All pumps must be installed with tags identifying pump to as-built mechanical and controls drawings.
- 4.3.1.5 Should the Contractor identify onsite conditions or design issues that could lead to cavitation within a pump, the Consultant must be notified prior to onsite construction.
- 4.3.1.6 Pumps to be installed complete with flex connections for vibration isolation.
- 4.3.1.7 All floor mounted pumps to be installed on 100mm [4"] concrete housekeeping pad.

END OF SECTION

PART 5 EVAPORATIVE CONDENSERS

5.1 GENERAL

- 5.1.1.1 The Contractor is responsible for performing all electrical and controls upgrades required by condensers.
- 5.1.1.2 SUBMITTALS:
 - 5.1.1.2.1 Submit with delivery of the condenser a copy of the factory inspection and test report. A copy of this report shall also be included with the O&M Manual project closeout data.
 - 5.1.1.2.2 Submit a site inspection and start-up report from the manufacturer's representative.
 - 5.1.1.2.3 Submit a signed copy of the condenser manufacturer's extended warranty, in the name of the Owner, for all condenser rotating mechanical equipment (fan, fan shaft, bearings, sheaves, motor, drive system, and mechanical equipment support) for 4 years following the date of expiration of the 1-year Contract warranty.
 - 5.1.1.2.4 The extended warranty is to be a written, full on-site parts and labour warranty with the same terms and conditions as the Contract warranty.
- 5.1.1.3 Condensers and all aspects of their installation are to be in accordance with Cooling Technology Institute CTI STD-105, Acceptance Test Code.

5.2 PRODUCTS

- 5.2.1.1 The approved condenser is the specified model. Alternate models can be proposed by the Contractor and will be approved at the discretion of the Consultant.
- 5.2.1.2 Basis of design: Evapco ATC-398E evaporative condenser, as scheduled on the drawings.
- 5.2.1.3 Unless otherwise noted, condensers are to be supplied with the following:
 - 5.2.1.3.1 Corrosion Resistant Coating: All steel panels and structural members, unless otherwise specified, are to be factory protected by a thermosetting hybrid polymer corrosion protection coating consisting of an electrostatically sprayed thermosetting hybrid polymer fuse bonded to the metal surfaces.

- 5.2.1.3.2 Passivation: Contractor responsible for performing passivation of all evaporative cooling equipment utilizing galvanized construction.
- 5.2.1.3.3 Contractor to contact water treatment vendor a minimum of 4 weeks prior to adding water to the system to provide equipment passivation plan. Contractor responsible for all costs associated with passivation of equipment.
- 5.2.1.3.4 Motors & Drives: TEFC motors, variable torque, specially insulated for exterior condenser duty, and adjustable V-belt drives with taper lock sheaves, adjustable motor base, and guard. The fan is to be equipped with a standard motor and drive capable of being controlled with a VFD.

5.3 EXECUTION

- 5.3.1.1 During demolition, protect all existing vibration isolated and seismically restrained piping support for re-use with the new condenser.
- 5.3.1.2 Install condensers on a structural steel base or concrete housekeeping pad level and plumb. The Contractor is responsible for structural and/or seismic engineering as specified.
- 5.3.1.3 The Contractor is responsible for ensuring that all reused, existing structural supports will last the life expectancy of the new condenser, with responsibilities including but not limited to inspection and refinishing.
- 5.3.1.4 Ensure adequate vibration isolation is installed.
- 5.3.1.5 Install components shipped loose with condensers.
- 5.3.1.6 Install fan motors, VFD, and all supporting equipment required for condenser operation.
- 5.3.1.7 Install piping, valves, purges, overflow, and valved drain piping as required for the operation of condensers.
- 5.3.1.8 Contractor responsible for ensuring that all outdoor condenser spray water piping can completely drain back to the remote sump tank when not in use to avoid freezing.
- 5.3.1.9 Connect condensers to the control systems and install control wiring in conduit in accordance with electrical work wiring standards.

END OF SECTION

PART 6 AMMONIA PIPING

6.1 GENERAL

6.1.1.1 Piping system work is to be in accordance with the following Codes and Standards:

- CAN/CSA B-52 Mechanical Refrigeration Code
- CAN/CSA B-51 Boiler Pressure Vessel and Piping Code
- ASME/ANSI B31.1 Power Piping
- ASME/ANSI B31.5 Refrigeration and Heat Transfer Components
- ASHRAE 15 Safety Standard for Refrigeration System
- ASHRAE Standard 34 Designation and Safety Classification of Refrigerants
- IAR2 Ammonia Refrigeration Piping Handbook

6.1.1.2 All applicable refrigeration piping to be pressure tested per CSA B52.

6.1.1.3 A pressure test of 1.1 times the design pressure shall be applied to all piping before being put into service. Pressure testing shall be held for 24 hrs. A picture detailing the gauge with a time stamp at the beginning and end of the pressure test shall be supplied to the Consultant.

6.1.1.4 The Contractor is responsible for the piping design registration and design submission of all ammonia piping to TSBC. For project continuity, it is recommended that the Consultant is hired to complete this work, however it is an option for the Contractor to complete it internally, if required.

6.2 PRODUCTS

6.2.1.1 All piping must be supplied capped and free of any internal debris or rust.

6.2.1.2 Piping 2-in or smaller must be schedule 80, ASTM SA106, grade B, seamless pipe.

6.2.1.3 Piping over 2-in must be schedule 40, ASTM SA106, grade B, seamless or ASTM SA53 grade B, welded (ERW).

6.2.1.4 Threaded pipe and fittings under 2.5-in to be schedule 80.

6.2.1.5 Welded fittings over 2-in to be SA-234-WPB fittings of the same size as the pipe being welded to.

6.2.1.6 Schedule 80 piping on all relief valve inlets and three-way valves.

6.2.1.7 Steel tubing 3/8-in and smaller shall be stainless steel.

6.2.1.8 Flanges, if used, must be approved for use with ammonia.

6.2.1.9 For simplicity, the following chart has been created:

PRIMARY REFRIGERATION PIPING SPECIFICATION	
<u>PIPING SHALL BEAR THE MILL TEST #</u>	
NOTE: COPY OF THE MILL TEST CERTIFICATES TO BE INCLUDED IN MANUAL	
NOTE: CONTRACTOR RESPONSIBLE FOR PROVIDING IMPACT TESTING, IN ACCORDANCE WITH ASME/ANSI B31.5, FOR ANY PIPING OPERATING BELOW ITS RATED TEMPERATURE RANGE.	
UP TO 2" IPS	
	> SCH.80.A106 GR. B SEAMLESS
	> IPS: SCHE 80 A 106 GR. B SEAMLESS WITH SOCKET WELD OR BUTT WELD CONNECTIONS
2 ½" IPS & OVER	
	> SCH.40 A53 GR.B ERW
	> A106 GR.B SEAMLESS
	> A333 GRADE 1 OR 6, TYPE E OR S (BELOW -20°F/-29°C).
FITTINGS--SHALL BEAR THE MANUFACTURER'S IDENTIFICATION	
UP TO 1 ½" IPS:	
	> FORGED STEEL SOCKET WELD ASTM A105 GR. 2.CLASS 3000.
	> THREADED CONNECTION WITH SAME SPECIFICATIONS, ONLY IF LOCATION APPROVED BY REFRIGERATION CONSULTANT
2" IPS & UP:	
	> CARBON STEEL BUTT WELD ASTM A234B, OR A105 OR A420 (BELOW -20°F/-29°C)
	> COMPATIBLE WITH THE WALL THICKNESS OF THE PIPE
TUBING – STAINLESS STEEL, 0.035" THK. WALL IN ¼" O.D. & ⅜" O.D SIZES.	
FITTINGS: PARKER-HANNIFIN CB CARBON STEEL COMPRESSION TYPE.	
FLANGES: ANSI RAISED FACE, ASTM A105 GR. 1 OR A181. GR 1 A105, A707 (BELOW -20°F/-29°C) RATING TO MATCH PIPE	
UNION: FORGED STEEL ASTM 105 GR. 2 300# WOG, STEEL TO STEEL GROUND JOINT, SOCKET WELD CONNECTIONS	

6.3 EXECUTION

- 6.3.1.1 Contractor to do all required piping system demolition work, as outlined in the attached drawing package.
- 6.3.1.2 Contractor to provide all required system piping, fittings, and joints.
- 6.3.1.3 Pipe and fittings 2.5-in and larger to be welded.

- 6.3.1.4 Welded fittings 2-in and smaller to be socket weld 3000 psi.
- 6.3.1.5 Provide shut-off valves and piping connections to refrigeration equipment.
- 6.3.1.6 Re-use existing restrained supports, including vibration isolation seismically restrained supports. Provide new supports to match existing supports where required.
- 6.3.1.7 All piping shall be provided with clearance around systems, equipment, and components for observation of operation, inspection, and servicing. Clearance must meet manufacturers' requirements, CSA B52, and the National Fire Code of Canada.
- 6.3.1.8 Piping must be installed with enough space to allow for disassembly and removal of equipment and components, per manufacturer recommendations.
- 6.3.1.9 Branch lines shall be installed with isolation and bypass lines with valves to allow for maintenance.
- 6.3.1.10 Bolt threads shall be lubricated with anti-seize compound.
- 6.3.1.11 Threaded joints in ferrous piping shall have NPT taper screw threads and shall be reamed and deburred before being used.
- 6.3.1.12 Piping which has potential for freezing, water condensation, and heat loss shall be protected by the appropriate insulation, vapor barrier, cladding. Refer to Mechanical Piping and Equipment Insulation for more information.
- 6.3.1.13 Ammonia discharge piping must, at a minimum, be painted with corrosion resistant paint.
- 6.3.1.14 Indoor piping insulation shall be protected by PVC cladding, per insulation specification.
- 6.3.1.15 Piping shall be installed to prevent liquid traps.
- 6.3.1.16 Where required, install drains in all low points, drain points, heat transfer outlets, and elsewhere to ensure reliable operation and maintenance, and drainage of liquid refrigerant back to receiver or chiller.
- 6.3.1.17 The Contractor will be responsible for the identification of all piping, valves and equipment installed under this contract. A list of existing valve tag numbers is to be used and added to as required. The Contractor will provide marked up P&IDs listing valve tag numbers at the end of the project.
- 6.3.1.18 Sloped piping is to be sloped at ¼" per foot unless otherwise specified.

6.3.2 PIPING SUPPORTS

- 6.3.2.1 All hangers, supports, and sway braces are to be in accordance with MSS SP58.
- 6.3.2.2 All piping is to be installed and supported per piping manufacturer recommendations.
- 6.3.2.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in the affected specification section.
- 6.3.2.4 All hangers and associated hardware located in corrosive or high-humidity environments (eg. pool environments, outdoors) must be stainless steel. All hangers inside the mechanical room (non-corrosive environment) may be painted or hot dipped galvanized.
- 6.3.2.5 Ensure steel hangers are in tensile loading only.
- 6.3.2.6 Cold piping NPS 2 or smaller can be supported by I-beam C clamps with a steel cup set screw, or a locknut and carbon steel retaining clip. Must be UL listed or FM approved.
- 6.3.2.7 Ensure that hanger rod is vertical in operating conditions.
- 6.3.2.8 All outside rooftop riser clamps are to be stainless steel, aluminum, or at a minimum hot dipped galvanized.
- 6.3.2.9 Piping supports shall be supported by bolts and only welded upon approval from a structural engineer.
- 6.3.2.10 All clevis plates must be secured with a minimum of 4 concrete inserts, one at each corner.
- 6.3.2.11 Per good piping practice, the following steel recommended piping support spacing table shall be adhered to. It should be noted that piping transitions, component inlets and outlets, flanges, valves, and other high piping load concentrations require more support than shown in the table below. In this case, the component or piping manufacturer shall be consulted for recommended piping supports.
- 6.3.2.12 Sch 40 and 80 Carbon Steel, PVC, and Copper Piping Support.

NOMINAL PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING			
		STEEL	PVC		COPPER
			SCHEDULE 40	SCHEDULE 80	
3/8" – 1 1/4"	3/8"	7'	4'	4'	5'
1 1/2"	3/8"	9'	5'	5'	8'
2"	3/8"	10'	5'	6'	8'
2 1/2"	1/2"	11'	6'	6'	9'
3"	1/2"	12'	6'	7'	10'
3 1/2"	1/2"	13'	6'	7'	11'
4"	5/8"	14'	6'	7'	12'
5"	5/8"	16'	6'	7'	13'
6"	3/4"	17'	7'	9'	14'
8"	3/4"	19'	8'	9'	16'
10"	7/8"	22'	8'	10'	
12"	7/8"	23'	9'	10'	
14"	1"	25'	10'	11'	
16"	1"	27'	10'	11'	

- 6.3.2.13 Piping and tubing smaller than 1" may require more support to reduce piping vibration. The Contractor must install sufficient support to avoid excessive vibration.
- 6.3.2.14 All piping must be supported accordingly.
- 6.3.2.15 Constant support hangers will be used when the vertical moment of the pipework is 13 mm or more, and variable support will be used where the variation in support effect does not exceed 25% of the total load.
- 6.3.2.16 Piping clamps and supports used on pipe transporting fluid above ambient air temperatures may penetrate through insulation.
- 6.3.2.17 Piping clamps and supports used on piping operating below ambient air temperatures shall not penetrate through insulation.
- 6.3.2.18 All piping shall be installed with appropriate seismic restraints per the geographic location of the project.

END OF SECTION

PART 7 AMMONIA SYSTEM VALVES

7.1 GENERAL

- 7.1.1.1 Refrigeration valves shall be registered in the jurisdiction that they are to be installed and conform with local codes and regulations.
- 7.1.1.2 Refrigeration valves to be installed in *British Columbia* must be registered with *Technical Safety BC* and have a *CRN number*.

7.2 GENERAL EXECUTION

- 7.2.1.1 Valves with a diameter less than 1-in shall be seal capped and socket welded where possible.
- 7.2.1.2 Valves with a diameter less than 1-in may be threaded when interfacing with components.
- 7.2.1.3 Valves with a diameter from 1-in to 2-in shall be seal capped and socket welded.
- 7.2.1.4 Valves with a diameter greater than 2-in shall be seal capped and butt welded.

7.2.2 SHUT OFF VALVES

7.2.2.1 PRODUCTS

- 7.2.2.1.1 Approved Manufacturers:
- 7.2.2.1.2 Danfoss, Hansen, and Parker are accepted manufacturers of shut off valves.
- 7.2.2.1.3 All shut off valves must be globe style.

7.2.2.2 EXECUTION

- 7.2.2.2.1 All major pieces of equipment must be installed with isolation valves to allow for maintenance and system shutdown.
- 7.2.2.2.2 All major pieces of equipment must be installed with a ¼-in purge valve used to allow for proper depressurization of equipment.

7.2.3 PRESSURE RELIEF VALVE

7.2.3.1 PRODUCTS

- 7.2.3.1.1 The accepted manufacturers of refrigerant pressure relief valves are Danfoss, Hansen, Cyrus Shank, and Parker.

7.2.3.2 EXECUTION

- 7.2.3.2.1 Pressure relief valves must be installed on all major pieces of equipment per CSA B52.
- 7.2.3.2.2 Contractor to install exact pressure relief valve models specified by the Consultant. Any substitutions must be approved by the Consultant prior to procurement.
- 7.2.3.2.3 Where required by CSA B52 code, all pressure vessels large enough must be installed with a three-way valve to allow for proper maintenance of pressure relief valves.
- 7.2.3.2.4 Schedule 80 piping to be installed on all relief valve inlets and three-way valves.

END OF SECTION

PART 8 CONDENSER SPRAY WATER PIPING AND VALVES

8.1 GENERAL

- 8.1.1.1 Piping system work is to be in accordance with the following Codes and Standards:
 - 8.1.1.1.1 ASTM A53, Standard Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 8.1.1.1.2 ASTM A105, Standard Specification for Carbon Steel Forgings for Piping Applications
 - 8.1.1.1.3 ASTM A536, Standard Specification for Ductile Iron Castings
 - 8.1.1.1.4 ANSI/ASME B16.4, Cast Iron Threaded Fittings
- 8.1.1.2 All field welding to be in accordance with the procedures of CSA-W117.2 and the current edition of ASME/ANSI B31.1 or B31.9 Code.
- 8.1.1.3 All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. (Combining products of multiple manufacturers is not permitted.) Grooving tools shall be of the same manufacturer as the grooved components.
- 8.1.1.4 The manufacturer shall be ISO 9001 certified.
- 8.1.1.5 All coupling, fitting, and valve (body and component) castings shall be date stamped for quality assurance and traceability.
- 8.1.1.6 Gaskets shall be molded and produced by the coupling manufacturer.
- 8.1.1.7 EPDM elastomer materials shall be developed, manufactured, and tested in the coupling manufacturer's facility. The EPDM shall be a proprietary blend that exceeds industry standards for performance over the long term.
- 8.1.1.8 The coupling manufacturer's gasket development and production shall be periodically audited by quality and polymer industry professionals.
- 8.1.1.9 The Victaulic proprietary blend is the only EPDM that is considered acceptable for hot water heating systems to 110°C / 230°F.
- 8.1.1.10 Contractor responsible for confirming thermal fluid chemistry and operating temperatures with grooved fitting manufacturer to ensure proper specification of gasket.
- 8.1.1.11 All grooved joint products shall comply with CSA B242.

- 8.1.1.12 Contractor to provide thermal calculations from grooved fitting supplier including all details for anchoring and expansion compensation.
Contractor to provide calculations in shop drawing review stage before installation.

8.1.2 WATER TREATMENT SERVICE

- 8.1.2.1 Provide for cleaning and degreasing of all systems that use glycol or water as a heat transfer medium.
- 8.1.2.2 Water treatment chemicals and treatment process shall be supplied and performed by the Contractor. This work shall be supervised by an approved professional chemical cleaning and treatment agency (the Water Treatment Specialist) who, upon completion shall certify that the process is satisfactory and submit a report outlining the cleaning operation and the treatment process.
- 8.1.2.2.1 For existing systems, confirm current Water Treatment Specialist and chemical supplier with the Owner.
- 8.1.2.3 The Water Treatment Specialist shall provide supervision of installations, set-up and adjustments and shall submit a written report on system operations.
- 8.1.2.4 All chemicals, feed systems and test equipment shall be provided by the Water Treatment Specialist.
- 8.1.2.5 Treatment chemicals shall not contain hydrazine.
- 8.1.2.6 Allow for replenishing of existing system levels where fluid is drained or system is expanded. At minimum, confirm initial water chemistry prior to starting new work and return system to these values prior to placing system back into service. Chemicals shall match existing.
- 8.1.2.7 Treatment chemicals shall be non-foaming.
- 8.1.2.8 The Water Treatment Specialist shall instruct the facility maintenance personnel before substantial completion. Written instructions of the treatment, dosages control charts and test procedures shall be included in the maintenance manuals.
- 8.1.2.9 On new systems, the Water Treatment Specialist shall provide monthly visits to check chemical treatment, take water samples and recommend any necessary changes to treatment, and provide a written report for a period of one year after substantial completion. Provide sufficient chemicals to treat the system from the time of commissioning to

acceptance of the building. In addition, provide a stock of chemicals, filters and corrosion coupons suitable for twelve (12) months normal operation. The minimum amount of chemicals provided shall include the following:

- 8.1.2.9.1 One spare drum (200L) of chemicals for each open system requiring treatment.
- 8.1.2.9.2 One spare pail (20L) of biocide for each open system requiring treatment.
- 8.1.2.9.3 One spare pail (20L) of chemicals for each closed system requiring treatment.
- 8.1.2.10 Provide a test kit suitable for all chemical treatments used. The test kit shall be made available for on-site tests and provide a Myron 3 range TDS meter to check conductivity. Hand over the kit to the Building Operator at project completion - obtain receipt.
- 8.1.2.11 Provide one mild steel and one copper corrosion coupon package to monitor corrosion rate for each open and closed system.

8.2 PRODUCTS

8.2.1 PIPE, FITTINGS AND JOINTS

- 8.2.1.1 Black Steel - Screwed Joint: Mild black carbon steel, Grade B, ERW, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.
- 8.2.1.2 Black Steel - Grooved End Mechanical Joint: Mild black carbon steel, Grade B, ERW, ASTM A53, factory or site roll grooved, complete with Victaulic Co. (or equal) cast ductile iron grooved end fittings, including full flow elbows, conforming to ASTM A536, and Victaulic Style 77 standard flexible couplings.
- 8.2.1.3 Victaulic Mechanical Couplings for Joining Carbon Steel Pipe:
 - 8.2.1.3.1 Victaulic Standard Mechanical Couplings, 2 inch (DN50) through 12 inch (DN300): Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. (Gaskets used for potable water applications shall be UL classified in accordance with ANSI/NSF-61 for potable water service.) Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-

183, minimum tensile strength 110,000 psi (758450 kPa) as provided standard Victaulic.

8.2.1.3.2 Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13.

8.2.1.3.3 2" (DN50) through 12" (DN300): Victaulic Style 107N (Quick-Vic™). Installation ready rigid coupling for direct stab installation without field disassembly. Center-leg gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 deg F (-34 deg C) to +250 deg F (+120 deg C).

8.2.1.4 Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the vibration source.

8.2.1.5 2" (DN50) through 8" (DN200): Victaulic Style 177 (Quick-Vic™). Installation ready flexible coupling for direct stab installation without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 deg F (-34 deg C) to +250 deg F (+120 deg C).

8.2.1.6 Flange Adapters: For use with grooved end pipe and fittings, flat faced, for mating to ANSI Class 125 / 150 flanges. Victaulic Style 741. For direct connection to ANSI Class 300 flanges use Victaulic Style 743.

8.2.1.7 Grooved couplings shall meet the requirements of ASTM F-1476.

8.2.1.8 Gasket: Synthetic rubber conforming to steel pipe outside diameter and coupling housing, manufactured of elastomers as designated in ASTM D-2000.

8.2.1.9 Reference shall always be made to the latest published Selection Guide for Victaulic Gaskets for proper gasket selection for the intended service.

8.2.2 SHUT-OFF VALVES

8.2.2.1 Butterfly Type: Cast ductile iron, lug body style, 1200 kPa (175 psi) rated butterfly valves, each suitable for bubble-tight dead-end service with the valve closed and either side of the connecting piping removed, and each complete with:

8.2.2.1.1 a neck to permit 2½" of insulation above the flange

- 8.2.2.1.2 a field replaceable EPDM seat
- 8.2.2.1.3 a bronze disc (316 stainless steel for brine)
- 8.2.2.1.4 a stainless-steel shaft with EPDM seal
- 8.2.2.2 Ball Valve: Class 600, 4140 kPa (600 psi) non-shock WOG rated, 2-piece, full port ball type valves, each complete with:
 - 8.2.2.2.1 a forged brass or bronze body (316 stainless steel for brine)
 - 8.2.2.2.2 blowout-proof stem
 - 8.2.2.2.3 solid forged brass or bronze chrome plated ball (316 stainless steel for brine)
- 8.2.2.3 "Teflon" or PTFE seat
- 8.2.2.4 a removable coated steel lever handle marked with valve identification
- 8.2.2.5 ends to suit the piping being connected
- 8.2.2.6 Valves in insulated piping are to be complete with stem extensions.
- 8.2.2.7 Acceptable manufacturers are:
 - Toyo Valve Co.
 - Milwaukee Valve Co.
 - Kitz Corporation
 - Conbraco Industries Inc. Apollo
 - Watts Water Technologies Inc.
- 8.2.2.8 Swing Check Valves
 - 8.2.2.8.1 In compliance with MSS-SP-71
 - 8.2.2.8.2 NPS 2-1/2" and over, flanged:
 - 8.2.2.8.3 ANSI Class 125 (860 kPa)
 - 8.2.2.8.4 Cast iron body, renewable or re-grindable seat, bronze swing disc, bolted cap
- 8.2.2.9 Silent Check Valves (Spring Type)
 - 8.2.2.9.1 NPS 2-1/2" through 12", grooved ends
 - 8.2.2.9.2 2065 kPa (300 PSI) non-shock W.O.G. rated
 - 8.2.2.9.3 Ductile iron body, electroless nickel plated seat, EPDM coated disk and seals, stainless steel spring and shaft.

8.2.3 WATER TREATMENT

8.2.3.1 EQUIPMENT

- 8.2.3.1.1 Corrosion Coupon and Holder Assembly:

- Mild steel corrosion coupon.
- Holder, 20 mm or 25 mm NPT male connection.
- Provide malleable or cast iron cross, 20 mm or 25 mm NPT female connection.

8.3 EXECUTION

- 8.3.1.1 During construction, protect all openings in piping and equipment, by capping or plugging to prevent entry of dirt.
- 8.3.1.2 Screw, or weld, fittings (unless otherwise specified) for all piping systems up to NPS 2.
- 8.3.1.3 Weld or Victaulic groove (unless otherwise specified) all piping systems NPS 2-1/2 and over.
- 8.3.1.4 Use long radius elbows. Victaulic #10 or W10 standard radius elbows may be used in lieu of long radius elbows in grooved piping systems in equipment rooms and where space considerations must be made.
- 8.3.1.5 Use eccentric reducers at pipe size changes, flush on top side, to permit positive venting and drainage.
- 8.3.1.6 Provide screwed unions or removable mechanical joint couplings in piping at all connections to valves, and at all equipment connections.
- 8.3.1.7 Provide shut-off valves in piping connections to all pieces of major equipment, including but not limited to injection loops, heat exchangers, and pumps.
- 8.3.1.8 Re-use existing retained supports, including vibration isolated seismically restrained supports. Provide new seismic supports where required to properly restrain pipe.
- 8.3.1.9 All piping shall be provided with clearance around systems, equipment, and components for observation of operation, inspection, and servicing. Clearance must meet manufacturers' requirements and the National Fire Code of Canada.
- 8.3.1.10 All piping must be installed with enough space to allow for disassembly, removal of equipment and components per manufacturer recommendations.
- 8.3.1.11 All piping greater than two inches shall be installed with butterfly isolation valves.

- 8.3.1.12 All piping smaller or equal to two inches shall be installed with ball isolation valves.
- 8.3.1.13 All branch lines shall be installed with isolation and bypass lines with valves to allow maintenance.
- 8.3.1.14 All drains shall be sloped towards drain.
- 8.3.1.15 Saddle type fittings may be used on branch tees where branch is less than half the size of the main. All saddles must be installed to maintain full inside diameter of branch line prior to welding saddle.
- 8.3.1.16 All dissimilar metals shall be connected with dielectric couplings appropriate for the application.
- 8.3.1.17 Install dielectric type unions or flanges or Victaulic Style 47 Clearflow Dielectric Waterways on "OPEN" type systems, where copper piping connects to steel. eg. domestic hot water tanks.
- 8.3.1.17.1 All bolt threads shall be lubricated with anti-seize compound.
- 8.3.1.18 All flanges mating to cast iron valve or equipment shall have flat faces.
- 8.3.1.19 Threaded joints in ferrous piping shall have NPT taper screw threads and shall be reamed and deburred before being used.
- 8.3.1.20 All piping which has potential for freezing, water condensation, and heat loss shall be protected by the appropriate insulation, vapor barrier, cladding, and heat trace where required.
- 8.3.1.21 Piping shall be installed to prevent air traps. Where required, install air vents at high points and elsewhere, and drains in all low points, drain points, heat transfer outlets and elsewhere to ensure reliable operation and maintenance.
- 8.3.1.22 The Contractor will be responsible for the identification of all piping, valves and equipment installed under this contract. A list of existing valve tag numbers is to be used and added to as required. The Contractor will provide marked up P&IDs listing valve tag numbers at the end of the project.

8.3.2 GROOVED JOINT PIPING

- 8.3.2.1 Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions.
- 8.3.2.2 Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

- 8.3.2.3 Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer.
- 8.3.2.4 The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products.
- 8.3.2.5 The representative shall periodically visit the jobsite and review that the contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

8.3.3 PIPING SUPPORTS

- 8.3.3.1 All hangers, supports, and sway braces are to be in accordance with MSS SP58.
- 8.3.3.2 All piping is to be installed and supported per piping manufacturer recommendations.
- 8.3.3.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in the affected specification section.
- 8.3.3.4 All hangers and associated hardware located in corrosive or high-humidity environments (eg. pool environments, outdoors) must be stainless steel. All hangers inside the mechanical room (non-corrosive environment) may be painted or hot dipped galvanized.
 - 8.3.3.4.1 Ensure steel hangers are in tensile load only.
- 8.3.3.5 Cold piping NPS 2 or smaller can be supported by I-beam C clamp with steel cup set screw, locknut and carbon steel retaining clip. Must be UL listed or FM approved.
- 8.3.3.6 Ensure that hanger rod is vertical in operating conditions.
- 8.3.3.7 All outside rooftop riser clamps to be stainless steel, aluminum, or at a minimum hot dipped galvanized.
- 8.3.3.8 Piping supports shall be supported by bolts and only welded upon approval from a structural engineer.
- 8.3.3.9 All clevis plates must be secured with a minimum of 4 concrete inserts, one at each corner.
- 8.3.3.10 All flexible joint roll grooved piping shall also be supported by at least one hanger at the piping joints.

- 8.3.3.11 Per good piping practice, the following recommended piping support spacing table shall be adhered to. It should be noted that piping transitions, pump inlets and outlets, flanges, valves, and other high piping load concentrations require more support than shown in the table below. In this case, the component or piping manufacturer shall be consulted for recommended piping supports.

MAXIMUM SPACING			
NOMINAL PIPE SIZE	ROD DIAMETER	STEEL	COPPER
≤ 1-¼"	⅜"	7'	7'
1 ½"	⅜"	9'	9'
2"	⅜"	10'	10'
2 ½"	½"	11'	11'
3"	½"	12'	12'
3 ½"	½"	13'	13'
4"	⅝"	14'	14'
5"	⅝"	16'	16'
6"	¾"	17'	17'
8"	¾"	19'	19'

- 8.3.3.12 Piping and tubing smaller than 1-in may require more supports to reduce piping vibrations. The Contractor must install sufficient supports to avoid excessive vibration.
- 8.3.3.13 All piping must be supported.
- 8.3.3.14 Constant support hangers will be used when the vertical moment of the pipework is 13 mm or more and variable support will be used where the variation in support effect does not exceed 25% of the total load.
- 8.3.3.15 Piping clamps and supports used on pipe transporting fluid above ambient air temperatures may penetrate through insulation.
- 8.3.3.16 Piping clamps and supports used on piping operating below ambient air temperatures shall not penetrate through insulation.
- 8.3.3.17 All piping shall be installed with appropriate seismic restraints per the geographic location of the project.

- 8.3.3.18 Provide shop drawings for pre-manufactured roof piping support systems. Contractor to include any support work and envelope details required to install.

8.3.4 VALVES

- 8.3.4.1 Install valves with stems upright or angled 45° above horizontal unless approved otherwise.
- 8.3.4.2 Use ball valves (NPS 2 and under) to shut off branch takeoffs and to isolate equipment.
- 8.3.4.3 Butterfly valves may be used for isolation as an alternative on chilled water, condenser water, hot water heating, heat pump and glycol heat recovery systems.
- 8.3.4.4 Provide valves upstream of all meters, gauges, automatic air vents, etc. for isolation purposes.
- 8.3.4.5 Use swing or spring loaded check valves, in horizontal and vertical upflow pipes and on the discharge of pumps. Spring loaded water check valves shall be located 8 pipe diameters downstream of pumps or elbows.

8.3.5 PRESSURE & LEAK TESTS

- 8.3.5.1 Notify the Consultant and the Inspection Authority Having Jurisdiction, a minimum of 48 hours in advance of intended test dates.
- 8.3.5.2 Before testing piping, isolate all equipment which cannot withstand the test pressure.
- 8.3.5.3 Do not insulate, backfill or conceal until tests have been completed and approved by the Inspection Authorities.
- 8.3.5.4 Examine all systems under test for leaks.
- 8.3.5.5 Joints shall remain dry during the test. Any moisture around a weld shall be reason for rejection.
- 8.3.5.6 Remake all leaking connections and joints.
- 8.3.5.7 Tests shall be limited to new piping only.
- 8.3.5.8 New connections to existing piping shall be warranted.
- 8.3.5.9 Initial Hydrostatic test: 150% of working pressure, but not less than 860 kPa [125 psig] for minimum 2 hours.
- 8.3.5.10 Final Hydrostatic test: 150% of working pressure, after piping connections to all equipment are complete, maintain until all parts of piping systems have been inspected.

8.3.6 WELDING TESTS

- 8.3.6.1 Replace welds of poor or doubtful quality at Contractor's expense.
- 8.3.6.2 In the event of weld rejection, the Owner has the right to insist on further testing at the Contractor's cost. Repairs will also be at the Contractor's cost.
- 8.3.6.3 Leave welds uncovered until inspected and approved by the Consultant or Boiler Inspection Branch.

END OF SECTION

PART 9 MECHANICAL INSULATION

9.1 GENERAL

- 9.1.1 This Section specifies thermal insulation requirements that are common to mechanical work Sections of the Specification. It is a supplement to each Section and is to be read accordingly.

9.1.2 SUBMITTALS

- 9.1.2.1 **Product Data Sheets & WHMIS Sheets:** Product data sheets must confirm that the product conforms to requirements of referenced Codes, Standards, and material properties.
- 9.1.2.2 **Fire Rated Duct Wrap Certification Letter:** Submit a letter from the fire rated duct wrap supplier to certify that the duct wrap has been properly installed.

9.1.3 QUALITY ASSURANCE

- 9.1.3.1 The company with the sub-contract for mechanical insulation work is to be a member in good standing of the Thermal Insulation Association of Canada.
- 9.1.3.2 Mechanical insulation requirements specified in this Section are based on the Thermal Insulation Association of Canada Best Practices Guide.
- 9.1.3.3 Mechanical insulation is to be applied by journeyman tradespersons in the Heat and Frost Insulation Trade. Registered apprentice tradespersons must be under direct, daily, on-site supervision of a journeyman.

9.1.4 DEFINITIONS

- 9.1.4.1 For the work of this Section:
- 9.1.4.1.1 **Concealed** means mechanical services and equipment above suspended ceilings, in non-accessible chases, in accessible pipe spaces, and furred-in spaces.
- 9.1.4.1.2 **Exposed** means exposed to normal view during normal conditions and operations.
- 9.1.4.1.3 **Domestic Water** means all piping (cold, hot, tempered) extended from the building Municipal supply main.
- 9.1.4.1.4 **WHMIS Sheets** means Workplace Hazardous Materials Information System sheets.

- 9.1.4.1.5 **Mineral Fibre** means a type of insulation manufactured from molten rock, slag, or glass in accordance with requirements of ASTM C547.
- 9.1.4.1.6 **PEX** means cross-linked polyethylene.
- 9.1.4.1.7 **Insulation System** means insulation material, fasteners, jacket, and any other accessory.
- 9.1.4.1.8 **TIAC** means Thermal Insulation Association of Canada.

9.2 PRODUCTS

9.2.1 FIRE HAZARD RATINGS

- 9.2.1.1 Unless otherwise specified, all insulation system materials inside the building and above ground must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

9.2.2 THERMAL PERFORMANCE

- 9.2.2.1 Unless otherwise specified, thermal performance, i.e. conductivity, of insulation is to meet or exceed the values given in the National Energy Code of Canada for Buildings, and ASHRAE/IES Standard 90.1.

9.2.3 PIPE INSULATION MATERIALS

- 9.2.3.1 **Horizontal Pipe Insulation at Hangers & Supports:** Insulated pipe support inserts consisting of minimum 150 mm (6-in) long, pre-molded, rigid, sectional phenolic foam or fiberglass insulation (of same thickness as adjoining insulation) with a reinforced foil and kraft paper vapour barrier jacket and a 180° captive galvanized steel saddle. Acceptable products are:
- Belform Insulation Ltd. "Koolphen K-Block"
 - Shur-Fit Products Ltd. "Pro-Pipe Supports"
- 9.2.3.2 **Specialty Insulation for Piping:** Factory fabricated foamed glass or closed cell foamed plastic insulation fittings specifically made for pipe mechanical joint fittings and couplings, and pipe risers at riser clamps. Acceptable manufacturers are:
- Shur-Fit Products Ltd.
 - Armacell Canada Inc.
 - Owens Corning "FOAMGLASS"
- 9.2.3.3 **Hot Piping Insulation (50 °C inside and 25 °C outside):** TIAC Standard 1501, Code A2, Preformed Mineral Fibre: Rigid, sectional, sleeve type insulation to ASTM Standard C 547, Standard Specification for Mineral Fibre Pipe

Insulation, supplied in 915 mm (3') lengths with a factory applied vapour barrier jacket and adhesive jacket closure to ASTM C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation, with a maximum thermal conductivity of 0.033 W/mK @ 24 °C.

- 9.2.3.4 **Cold Piping (Operating below the ambient dew point and above 0 °C) TIAC Standard 1501, Code A6, Flexible Foam Elastomeric:** Closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation in accordance with requirements of ASTM C534, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form, maximum thermal conductivity of 0.039 W/mK @ 24 °C, minimum density of 96 kg/m³, and supplied with all required installation accessories.

- 9.2.3.5 **Cold Piping Insulation: XPS Extruded Styrofoam (Below 0 °C):** Rigid, sectional, insulation used for cold piping. With a service temperature range of -297 °F to 165 °F (-183 °C to 74 °C).

9.2.4 EQUIPMENT INSULATION MATERIALS

- 9.2.4.1 **Hot Equipment (Operating above 50 °C) TIAC Standard 1501, Code A6, Flexible Foam Elastomeric:** Closed cell. Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form, maximum thermal conductivity of 0.039 W/mK @ 24 °C, minimum density of 96 kg/m³, and supplied with all required installation accessories.

- 9.2.4.2 **Cold Equipment (Operating below the ambient dew point and above 0 °C) TIAC Standard 1501, Code A6, Flexible Foam Elastomeric:** Closed cell. Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form, maximum thermal conductivity of 0.039 W/mK @ 24 °C, minimum density of 96 kg/m³, and supplied with all required installation accessories.

- 9.2.4.3 **Cold Equipment Insulation: XPS Extruded Styrofoam (Below 0 °C):** Rigid, sectional, insulation used for cold piping. With a service temperature range of -297 °F to 165 °F (-183 °C to 74 °C).

9.2.5 DUCTWORK SYSTEM INSULATION MATERIALS

- 9.2.5.1 **TIAC Standard 1502, Code A2, Rigid Mineral Fibre Board:** Preformed board type insulation to ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation, with a factory applied reinforced aluminum foil and Kraft paper facing to ASTM C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation, a minimum

thermal conductivity of 0.033 W @ 24 °C, and a minimum density of 48 kg/m³.

- 9.2.5.2 **TIAC Standard 1502, Code B2, Flexible Mineral Fibre:** Roll form insulation to ASTM C1290, Standard Specification for Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts, with a factory applied vapour barrier facing to ASTM C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation, a minimum thermal conductivity of 0.042 W @ 24 °C, and a minimum density of 12 kg/m³.

9.2.6 PIPE PROTECTION

- 9.2.6.1 Prior to insulating, all ferrous piping operating with fluids below the ambient dew point must be coated with either epoxy primer and epoxy painted or Polyguard Rg-2400 LT.
- 9.2.6.2 Factory painted equipment or piping does not require paint unless the type of paint is not approved for use in the specified area, or the factory coating is damaged, scuffed, or chipped.
- 9.2.6.3 The Contractor is responsible for ensuring that all insulated equipment and piping that has not received the treatment listed in section 9.2.6 is stripped of insulation, treated as listed in section 9.2.6, and re-insulated.

9.2.7 INSULATION FASTENINGS

- 9.2.7.1 **Aluminium Jacketing Stainless Steel Banding:** Equal to Childers Products Co. "FABSTRAPS" 0.6 mm (1/16-in) thick, minimum 12 mm (½-in) wide type 304 stainless steel strapping.
- 9.2.7.2 **Tape Sealant:** Equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match the surface being sealed.
- 9.2.7.3 **Adhesive – Mineral Fibre Insulation:** Clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20 °C to 82 °C (-4 °F to 180 °F), compatible with the type of material to be secured, and WHMIS classified as non-hazardous.
- 9.2.7.4 **Adhesive – Closed Cell Foamed Glass Insulation:** Equal to Pittsburgh Corning PC88 multi-purpose two-component adhesive.
- 9.2.7.5 **Lagging Adhesive:** White, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.
- 9.2.7.6 **Sheet Metal Screws:** No. 10 stainless steel sheet metal screws.

9.2.8 INSULATION VAPOUR BARRIER

- 9.2.8.1 All vapour barrier to have a permeance rating less than or equal to .02 Perm.
- 9.2.8.2 All Hot Piping Insulation shall be supplied with manufacturer's vapour barrier.
- 9.2.8.3 All Styrofoam XPS Extruded Styrofoam insulation shall have a factory applied vapour barrier. Alternatively, the insulation may be covered with a field applied, Henry Blueskin SA, winter grade.
- 9.2.8.4 ITW Saran 520 tape to be used to seal piping vapour barrier.
- 9.2.8.5 All butt seams in Saran vapour barrier to be taped with 3" wide Saran 520 tape or Venture Clad Cryogenic Tape.
- 9.2.8.6 All valves, fittings, and other equipment to have vapour barrier of ITW Insulation Saran 560 or Venture Clad Cryogenic tape. Vapour barrier and tape must be applied per manufacturer's specifications.

9.2.9 INSULATION JACKETS AND FINISHES

- 9.2.9.1 **PVC Jacketing to be Used on Interior Piping, Valves, and Equipment:** TIAC Code C1, PVC: Roll form sheet and fitting covers in accordance with ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds, minimum 15 mil thick, white, PVC, 25/50 rated, complete with installation and sealing accessories.
- 9.2.9.2 **Aluminum Jacketing Exterior Piping Insulation, Valves, and Equipment:** TIAC Code C2, Rigid Aluminum: Equal to Childers Metals "Lock-on" 0.020" thick stucco embossed aluminum jacket material to ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate, factory cut to size and complete with PolyFilm Moisture Barrier (PFMB) and continuous modified Pittsburgh Z-Lock, and "Fabstraps" and butt straps to cover end to end joints. Fittings are to be 2-piece epoxy coated pressed aluminum with weather locking edges.
- 9.2.9.3 All insulation inside the building 7 feet above grade shall be finished with 0.020" thick, white PVC with a self-seal lap.
- 9.2.9.4 All insulation inside of the building below 7 feet from grade shall be finished with 0.030" thick, white PVC with a self-seal lap.
- 9.2.9.5 All insulation exposed to the outdoors, inside the mechanical room, and outside shall be jacketed with 16 mil, stucco embossed, anodized aluminum.

9.2.10 REMOVABLE/REUSABLE INSULATION COVERS

- 9.2.10.1 **Valve, Etc. Covers:** Custom manufactured covers conforming to the shape of the item to be insulated, designed to be easily removable and replaceable to suit the use and maintenance procedures of the particular item, and to provide adequate personnel protection. All equipment cover insulation and access locations must be approved by the Consultant.
- 9.2.10.2 **Equipment Covers:** Custom manufactured covers conforming to the shape of the item to be insulated, designed to be easily removable and replaceable to suit the use and maintenance procedures of the particular item, and to provide adequate personnel protection. All equipment cover insulation and access locations must be approved by the Consultant.

9.3 EXECUTION

9.3.1 GENERAL INSULATION APPLICATION REQUIREMENTS

- 9.3.1.1 Unless otherwise specified, do not insulate the following:
- Factory insulated equipment and piping
 - Brine Pumps used below the ambient dew point.
 - Domestic water and heating system expansion tanks
- 9.3.1.2 Do not apply insulation unless piping leakage tests have been satisfactorily completed.
- 9.3.1.3 Ensure that all surfaces to be insulated are clean and dry.
- 9.3.1.4 Ensure that the ambient temperature is minimum 13 °C (55 °F) for at least one day prior to the application of insulation, and for the duration of insulation work, and that relative humidity is and will be at a level such that mildew will not form on insulation materials.
- 9.3.1.5 All insulation materials must be stored on site in a proper and dry storage area. Any wet insulation material is to be removed from the site and replaced. Any costs incurred due to storing, removing, and/or replacing insulation materials are the responsibility of the Contractor.
- 9.3.1.6 Install hot piping insulation directly over pipes and not over hangers and supports.
- 9.3.1.7 Install high density jacketing insulation inserts at hangers and supports.
- 9.3.1.8 Install piping insulation and jacket continuous through pipe openings and sleeves.
- 9.3.1.9 All insulation shall be installed with appropriate vapor barriers with a permeance rating less than or equal to 0.02 Perms. Mineral insulation may be installed with factory applied vapour-retardant jacket.

- 9.3.1.10 All joints shall be taped to prevent a break in the vapour barrier.
- 9.3.1.11 Caulk all joints and fittings in jacketing with a colour matching sealant.
- 9.3.1.12 Ensure water shedding on all installed jacketing.
- 9.3.1.13 Stainless banding must be installed wherever aluminum jacketing or cold piping insulation ($< 0^{\circ}\text{C}$) is used. Banding must be provided at all circumferential edges and not more than 12" between centers.
- 9.3.1.14 All damage and dents shall be removed.
- 9.3.1.15 Exterior surfaces shall be cleaned of any dirt, oil, or other contaminants.
- 9.3.1.16 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect the insulation jacketing from the action of condensation at its junction with the metal.
- 9.3.1.17 When insulating vertical piping risers 75 mm (3-in) diameter and larger, use insulation support rings welded directly above the lowest pipe fitting, and thereafter at 4.5 m (15-ft) centres and at each valve and flange. Insulate as per Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.
- 9.3.1.18 Where insulation is terminated at valves, equipment, unions, etc., neatly cover the exposed end of the insulation with a purpose made PVC or aluminum cover.
- 9.3.1.19 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.
- 9.3.1.20 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in the insulation and provide a suitable grommet in the opening.
- 9.3.1.21 Insulate, vapour seal, and finish all seismic restraints, braces, anchors, hanger rods, and similar hardware directly connected to "cold" piping and/or equipment, for a distance of 300mm (12") clear of the adjacent pipe or equipment finish, to match the piping and/or equipment insulation.
- 9.3.1.22 Where existing insulation work is damaged because of new mechanical work, repair the damaged insulation work to new work standards.

- 9.3.1.23 Fire stop penetrations shall be insulated with Closed Cell Foamed Glass insulation. Closed Cell Foamed Glass segments must match adjacent insulation (diameter and joint type).
- 9.3.1.24 Combustible pipes penetrating fire rated partitions must use intumescent fire stop collars, Hilti Firestop Collar, or approved equal installed in accordance with the manufacturer's instructions.

9.3.2 COLD PIPING INSULATION USING XPS EXTRUDED STYROFOAM

- 9.3.2.1 All shut-off valves and elbows to be factory fabricated.
- 9.3.2.2 All elbow joints to be tongue and groove.
- 9.3.2.3 All vessel head insulation to be factory fabricated to match the geometry and contour of the vessel head. All vessel head insulation of 2" or more thickness must be double layer.
- 9.3.2.4 All Styrofoam PIB pipe insulation 2" and less thickness shall have longitudinal joint of the tongue and groove or ship-lap style joint.
- 9.3.2.5 All Styrofoam PIB insulation over 2" thick shall be double layer.
- 9.3.2.6 All piping and vessel sidewall insulation to be supplied in 36" long segments.
- 9.3.2.7 All insulation 20" finished diameter and smaller to be taped with filament tape every 9".
- 9.3.2.8 All insulation over 20" finished diameter to be secured with ½" stainless steel banding every 9". Prior to application of vapor barrier, sharp edges must be flattened to prevent damage to vapor barrier.
- 9.3.2.9 Apply a non-setting, low temperature joint sealant on all longitudinal and butt joints. On double and triple layer applications, apply joint sealant on second and third layers only.
- 9.3.2.10 Provide vapor stops on valves, end caps and termination points.

9.3.3 INSULATION FOR PIPE MECHANICAL JOINT FITTINGS & COUPLINGS, ETC.

- 9.3.3.1 Provide manufactured insulation fittings, the same thickness as the adjoining pipe insulation, for mechanical joint fittings and couplings, and for piping at riser clamps through the floor. Cover with purpose made PVC or aluminium covers or jacketing sealed with tape.

9.3.4 INSULATION FOR HORIZONTAL PIPE AT HANGERS AND SUPPORTS

- 9.3.4.1 At each hanger and support location for piping 50 mm (2") diameter and larger and scheduled to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply the insulation sections to the piping installers for installation as the pipe is erected.
- 9.3.4.2 For 100 mm (4") diameter and larger heating system piping where roller type hangers and supports are provided, a steel saddle will be tack welded to the pipe at each roller hanger or support location. Pack saddle voids with loose mineral fibre insulation.

9.3.5 PIPE INSULATION REQUIREMENTS

- 9.3.5.1 INSIDE BUILDING & ABOVE GROUND (TEMPERATURE RANGE ABOVE 50 °C)
- 9.3.5.1.1 Insulate pipe inside the building and above ground, as scheduled below, in accordance with TIAC Quality Standard 1501, Piping, as follows:
- 9.3.5.1.2 **Material:** Type A3 mineral fibre, factory applied vapour barrier and PVC cladding.
- 9.3.5.1.3 **Insulation application:** 1501-H for hot piping.
- 9.3.5.1.4 **Insulation finish:** CPF/4 PVC jacket for exposed piping
- 9.3.5.1.5 TIAC Standard 1501 Code A6 foamed elastomeric insulation may be used in lieu of Type A2, with 1501-CA application and specified finish.
- 9.3.5.1.6 Insulation thickness in accordance with the following table:

PIPE SERVICE	DIAMETER	INSULATION THICKNESS
DOMESTIC HOT WATER, SUPPLY & RECIRCULATION	TO 40 MM	25 MM
	LARGER THAN 40 MM	50 MM
TEMPERED DOMESTIC WATER	ALL	25 MM
LOW PRESSURE (140 KPA) STEAM	TO 40 MM	25 MM
	LARGER THAN 40 MM	50 MM
LOW PRESSURE CONDENSATE	TO 40 MM	25 MM
	LARGER THAN 40 MM	50 MM
MEDIUM PRESSURE (140-415 KPA) STEAM	TO 40 MM	40 MM
	LARGER THAN 40 MM	50 MM
MEDIUM PRESSURE CONDENSATE	TO 40 MM	40 MM
	LARGER THAN 40 MM	50MM
STEAM BOILER FEED WATER	ALL	40 MM
STEAM BOILER BLOWDOWN	ALL	40 MM
REFRIGERANT SUCTION & HOT GAS (SEE NOTE # 1)	ALL	25 MM
REFRIGERANT HOT GAS BY-PASS (SEE NOTE # 1)	ALL	25 MM
HEAT PUMP EARTH LOOP	ALL	25 MM
HEATING WATER, SUPPLY & RETURN	TO 50 MM	25 MM
	LARGER THAN 50 MM	40 MM
HEATING GLYCOL SOLUTION, SUPPLY & RETURN CHILLED GLYCOL SOLUTION, SUPPLY & RETURN	TO 50 MM	25 MM
	LARGER THAN 50 MM	40 MM
PIPING TO BE TRACED WITH HEATING CABLE	TO 50 MM	25 MM
	LARGER THAN 50 MM	40 MM

9.3.5.2 INSIDE BUILDING & ABOVE GROUND (TEMPERATURE RANGE BELOW HIGHEST AMBIENT DEW POINT AND ABOVE 0 °C)

9.3.5.2.1 Insulate pipe inside the building and above ground, as scheduled below, in accordance with TIAC Quality Standard 1501, Piping, as follows:

9.3.5.2.2 **Material:** Flexible Foam Elastomeric, with vapour barrier, and PVC jacketing

9.3.5.2.3 **Insulation application:** 1501-C for cold piping

9.3.5.2.4 **Insulation finish:** CPF/4 PVC jacket for exposed piping.

9.3.5.2.5 Insulation thickness in accordance with the following table:

PIPE SERVICE	DIAMETER	INSULATION THICKNESS
CHILLED WATER SUPPLY & RETURN	TO 100 MM	25 MM
	LARGER THAN 100 MM	40 MM
CHILLED GLYCOL SOLUTION SUPPLY & RETURN	TO 100 MM	25 MM
	LARGER THAN 100 MM	40 MM
REFRIGERANT SUCTION LINES	ALL	25 MM
HEAT PUMP EARTH LOOP	ALL	25 MM

9.3.5.3 INSIDE BUILDING & ABOVE GROUND (TEMPERATURE RANGE BELOW 0 °C)

9.3.5.3.1 Insulate pipe inside the building and above ground, as scheduled below, in accordance with TIAC Quality Standard 1501, Piping, as follows:

9.3.5.3.2 **Material:** XPS Extruded Styrofoam, with Henry Blueskin vapour barrier, and PVC jacketing

9.3.5.3.3 **Insulation application:** 1501-C for cold piping

9.3.5.3.4 **Insulation finish:** CPF/4 PVC jacket for exposed piping

9.3.5.3.5 Insulation thickness in accordance with the following table:

NOM PIPE SIZE (IN)	SERVICE TEMPERATURE (°F)					
	-60.0	-40.0	-20.0	00	20.0	40.0
1/2	2.5	2.0	2.0	1.5	1.5	1.0
3/4	2.5	2.5	2.0	2.0	1.5	1.5
1	2.5	2.5	2.0	2.0	1.5	1.5
1 1/4	3.0	2.5	2.5	2.0	1.5	1.5
1 1/2	2.5	2.0	2.5	2.0	1.5	1.5
2	3.0	2.5	2.5	2.0	1.5	1.5
2 1/2	2.5	2.5	2.5	2.0	1.5	1.5
3	3.0	3.0	2.5	2.0	2.0	1.5
4	3.0	3.0	2.5	2.5	2.0	1.5
6	3.5	3.0	3.0	2.5	2.0	1.5
8	3.5	3.0	3.0	2.5	2.0	1.5
10	3.5	3.5	3.0	2.5	2.0	1.5
HORIZONTAL VESSEL	5	4.5	3.5	3	2.5	2.0
VERTICAL VESSEL	5	4.5	3.5	3	2.5	2.0

9.3.5.4 OUTSIDE BUILDING & ABOVE GROUND (TEMPERATURE RANGE ABOVE 25 °C)

9.3.5.4.1 Insulate pipe outside the building and above ground, as scheduled below, in accordance with TIAC Quality Standard 1501, Piping, as follows:

- 9.3.5.4.2 **Material:** Type A2 mineral fibre, factory applied vapour barrier and aluminum cladding.
- 9.3.5.4.3 **Insulation application:** 1501-H for hot piping
- 9.3.5.4.4 **Insulation finish:** CPF/3
- 9.3.5.4.5 Insulation thickness in accordance with the following table:

PIPE SERVICE	DIAMETER	INSULATION THICKNESS
HEATING WATER, SUPPLY & RETURN	TO 50 MM	50 MM
	LARGER THAN 50 MM	50 MM
HEATING GLYCOL SOLUTION, SUPPLY & RETURN	TO 50 MM	50 MM
	LARGER THAN 50 MM	50 MM
CHILLED GLYCOL SOLUTION, SUPPLY & RETURN	TO 50 MM	25 MM
	LARGER THAN 50 MM	40 MM
CHILLED GLYCOL SOLUTION, SUPPLY & RETURN	TO 50 MM	25 MM
	LARGER THAN 50 MM	40 MM

9.3.5.5 OUTSIDE BUILDING & ABOVE GROUND (TEMPERATURE RANGE BELOW 5 °C)

- 9.3.5.5.1 Insulate pipe outside the building and above ground, as scheduled below, in accordance with TIAC Quality Standard 1501, Piping, as follows:
- 9.3.5.5.2 **Material:** XPS Extruded Styrofoam, with Henry Blueskin vapour barrier, and aluminum jacketing
- 9.3.5.5.3 **Insulation application:** 1501-H for hot piping
- 9.3.5.5.4 **Insulation finish:** CPF/3
- 9.3.5.5.5 Insulation thickness in accordance with the following table:

NOM PIPE SIZE (IN)	SERVICE TEMPERATURE (°F)					
	-60.0	-40.0	-20.0	00	20.0	40.0
1/2	2.5	2.0	2.0	1.5	1.5	1.0
3/4	2.5	2.5	2.0	2.0	1.5	1.5
1	2.5	2.5	2.0	2.0	1.5	1.5
1 1/4	3.0	2.5	2.5	2.0	1.5	1.5
1 1/2	2.5	2.0	2.5	2.0	1.5	1.5
2	3.0	2.5	2.5	2.0	1.5	1.5
2 1/2	2.5	2.5	2.5	2.0	1.5	1.5
3	3.0	3.0	2.5	2.0	2.0	1.5
4	3.0	3.0	2.5	2.5	2.0	1.5
6	3.5	3.0	3.0	2.5	2.0	1.5
8	3.5	3.0	3.0	2.5	2.0	1.5
10	3.5	3.5	3.0	2.5	2.0	1.5
HORIZONTAL VESSEL	5	4.5	3.5	3	2.5	2.0
VERTICAL VESSEL	5	4.5	3.5	3	2.5	2.0

9.3.5.6 UNDERGROUND INSIDE & OUTSIDE BUILDING (BELOW 10C AND ABOVE 30C)

9.3.5.6.1 Insulate pipe underground inside and outside the building, as scheduled below, in accordance with TIAC Quality Standard 1501, Piping, as follows:

9.3.5.6.2 **Material:** Type A7 closed cell cellular glass

9.3.5.6.3 **Insulation application:** 1501-U

9.3.5.6.4 **Insulation finish:** weather-proof coating as per insulation manufacturer's instructions.

9.3.5.6.5 Insulation thickness in accordance with the following table:

PIPE SERVICE	DIAMETER	INSULATION THICKNESS
HEATING WATER, SUPPLY & RETURN	ALL	50 MM
CHILLED WATER, SUPPLY & RETURN	ALL	50 MM
HEATING GLYCOL SOLUTION, SUPPLY & RETURN	ALL	50 MM
CHILLED GLYCOL SOLUTION SUPPLY AND RETURN	ALL	50 MM
CHILLED BRINE SOLUTION SUPPLY AND RETURN	ALL	50 MM

9.3.6 EQUIPMENT INSULATION REQUIREMENTS

9.3.6.1 INSIDE BUILDING (ABOVE 40 °C)

9.3.6.1.1 Insulate equipment inside the building, as scheduled below, in accordance with TIAC Quality Standard 1503, Equipment, as follows:

- 9.3.6.1.2 **Material:** Type AID semi-rigid mineral fiber, with vapour barrier, and PVC jacketing
- 9.3.6.1.3 **Insulation application:** 1503-H for hot tanks and equipment
- 9.3.6.1.4 **Insulation finish:** CEF/2 for hot tanks and equipment
- 9.3.6.1.5 Insulation thickness in accordance with the following table:

EQUIPMENT	INSULATION THICKNESS
ALL EQUIPMENT ABOVE 60 °C	50 MM
ALL EQUIPMENT UP TO 60 °C	25 MM

- 9.3.6.2 **INSIDE BUILDING (BELOW HIGHEST AMBIENT DEW POINT AND ABOVE 0 °C)**
- 9.3.6.2.1 Insulate equipment inside the building, as scheduled below, in accordance with TIAC Quality Standard 1503, Equipment, as follows:
- 9.3.6.2.2 **Material:** Fibre Flexible Foam Elastomeric, with vapour barrier, and PVC jacketing
- 9.3.6.2.3 **Insulation application:** 1503-C for cold tanks and equipment
- 9.3.6.2.4 **Insulation finish:** CEF/1 for cold tanks and equipment
- 9.3.6.2.5 Insulation thickness in accordance with the following table:

EQUIPMENT	INSULATION THICKNESS
ALL EQUIPMENT	25 MM

- 9.3.6.3 **INSIDE BUILDING (BELOW 0 °C)**
- 9.3.6.3.1 Insulate equipment inside the building, as scheduled below, in accordance with TIAC Quality Standard 1503, Equipment, as follows:
- 9.3.6.3.2 **Material:** XPS Extruded Styrofoam, with Henry Blueskin vapour barrier, and PVC jacketing
- 9.3.6.3.3 **Insulation application:** 1503-C for cold tanks and equipment
- 9.3.6.3.4 **Insulation finish:** CEF/1 for cold tanks and equipment
- 9.3.6.3.5 Insulation thickness in accordance with the following table:

NOM PIPE SIZE (IN)	SERVICE TEMPERATURE (°F)					
	-60.0	-40.0	-20.0	00	20.0	40.0
1/2	2.5	2.0	2.0	1.5	1.5	1.0
3/4	2.5	2.5	2.0	2.0	1.5	1.5
1	2.5	2.5	2.0	2.0	1.5	1.5
1 1/4	3.0	2.5	2.5	2.0	1.5	1.5
1 1/2	2.5	2.0	2.5	2.0	1.5	1.5
2	3.0	2.5	2.5	2.0	1.5	1.5
2 1/2	2.5	2.5	2.5	2.0	1.5	1.5
3	3.0	3.0	2.5	2.0	2.0	1.5
4	3.0	3.0	2.5	2.5	2.0	1.5
6	3.5	3.0	3.0	2.5	2.0	1.5
8	3.5	3.0	3.0	2.5	2.0	1.5
10	3.5	3.5	3.0	2.5	2.0	1.5
HORIZONTAL VESSEL	5	4.5	3.5	3	2.5	2.0
VERTICAL VESSEL	5	4.5	3.5	3	2.5	2.0

1.2 REMOVABLE/REUSABLE TYPE

9.3.6.4 Provide custom designed and manufactured removable and reusable insulation covers for the following:

9.3.6.4.1 Plate type heat exchanger(s)

9.3.6.4.2 150 mm (6") diameter and larger piping strainers, backflow preventers, etc.

9.3.7 APPLICATION OF INSULATING AND PROTECTIVE COATINGS

9.3.7.1 Apply insulating and protective coatings in accordance with the manufacturer's instructions. Remove any splatter from adjacent surfaces. Apply insulating/protective coating to the following surfaces:

9.3.7.1.1 Paint all bare metal surfaces clear of "cold" piping and/or equipment insulation for between 300 mm (12") and 600 mm (24") clear of the pipe or equipment insulation, with "No Sweat-FX" anti-condensation coating.

9.3.7.1.2 Paint all bare metal surfaces associated with mechanical systems with an operating temperature above 60 °C (140 °F) with "ThermaLite" insulating coating.

9.3.7.1.3 Paint all seismic restraint hardware such as hanger rods, braces, anchors, etc., as specified on the first two points above.

9.3.8 DUCTWORK SYSTEM INSULATION REQUIREMENTS – INSIDE BUILDING

9.3.8.1 Insulate duct systems inside the building and above ground, as scheduled below, in accordance with TIAC Quality Standard 1502, Ductwork and Plenums, as follows:

9.3.8.2 Material:

9.3.8.2.1 Type A2 rigid mineral fibre for exposed rectangular ducts, and all plenums

9.3.8.2.2 Type B2 flexible mineral fibre for concealed rectangular ducts, and concealed and exposed round or oval ducts

9.3.8.3 Insulation Application:

9.3.8.3.1 CER/1 for heating and ventilating system rigid insulation

9.3.8.3.2 CER/2 for heating and air conditioning system rigid insulation

9.3.8.3.3 CEF/1 for heating and ventilation system flexible insulation

9.3.8.3.4 CEF/2 for heating and air conditioning system flexible insulation

9.3.8.3.5 Insulation Finish:

9.3.8.3.6 CRF/1 for exposed rectangular duct systems

9.3.8.3.7 CRD/1 for exposed round/oval duct systems

DUCT SYSTEM SERVICE	INSULATION THICKNESS	
	RIGID INSULATION	FLEXIBLE INSULATION
DEHUMIDIFIER SUPPLY AND RETURN DUCTS	NONE	NONE
FRESH (OUTSIDE) AIR DUCTS	40 MM	50 MM
FRESH (OUTSIDE) AIR CASINGS AND PLENUMS	40 MM	N/A
MIXED AIR CASINGS AND PLENUMS	25 MM	N/A
MIXED AIR SUPPLY DUCTS (EXCEPT WHERE EXPOSED IN AREA SERVED)	25 MM	40 MM
3M OF EXHAUST DISCHARGE DUCTS DOWNSTREAM (BACK) FROM EXHAUST OPENINGS TO ATMOSPHERE	25 MM	40 MM
EXHAUST AIR CASINGS AND PLENUMS WITHIN 3M OF EXHAUST OPENINGS TO ATMOSPHERE	25 MM	N/A
HEAT RECOVERY SYSTEM FRESH HEATED AIR	25 MM	40 MM
EXTERIOR DUCTWORK	–	75MM

9.3.8.4 Provide commercial quality corner bead only on exposed rigid duct, plenum and casing insulation in all equipment rooms, corridors, and similar areas where the insulation is subject to damage.

9.3.9 COMMON DUCT SYSTEM INSULATION APPLICATION REQUIREMENTS

- 9.3.9.1 At duct connection flanges insulate the flanges with neatly cut strips of the rigid insulation material secured with adhesive to side surfaces of the flange with a top strip to cover the exposed edges of the side strips, then butt the flat surface duct insulation up tight to the flange insulation, or alternatively, increase the insulation thickness to the depth of the flange and cover the top of the flanges with tape sealant.
- 9.3.9.2 The installation of fastener pins and washers is to be concurrent with the duct insulation application.
- 9.3.9.3 Cut insulation fastener pins almost flush to the washer and cover with neatly cut pieces of tape sealant.
- 9.3.9.4 Accurately and neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers.
- 9.3.9.5 Prior to concealment of insulation by either construction finishes or jacket material, patch all vapour barrier damage by means of tape sealant.
- 9.3.9.6 At trapeze hanger locations for rectangular duct install insulation between the duct and the hanger.
- 9.3.9.7 At each duct hanger for round and provide a 100 mm (4") wide full-length piece of rigid mineral fibre board insulation between the duct and the hanger.

END OF SECTION

PART 10 CONTROLS & AUTOMATION

10.1 GENERAL

10.1.1 QUALITY ASSURANCE

- 10.1.1.1 Control system must be thoroughly tested for functionality following the integration of all new equipment to ensure proper operation in all scenarios.
- 10.1.1.2 Proof of proper operation is to be provided to the Owner and to the Consultant.
- 10.1.1.3 Contractor is responsible for providing the Consultant with control system remote access for the first year of operation.

10.2 PRODUCTS

10.2.1 CONTROLS SYSTEM

- 10.2.1.1 Acceptable controls system manufacturers include Delta, Reliable and any equivalent brand with respect to options, functionality, quality, and control.
- 10.2.1.2 Contractor shall modify and integrate with the existing controls system unless noted otherwise.
- 10.2.1.3 Contractor to provide a controls system that can be accessed and controlled remotely using an internet connection.
- 10.2.1.4 The controls system must not be locked down by the Contractor. The Contractor must ensure that all programs are editable by the Owner, Consultant, or other contractors.
- 10.2.1.5 The Contractor must deliver a copy of the program, graphics, and remote access information to the Owner.

10.2.2 ELECTRICAL COMPONENTS, WIRING AND CONDUIT

- 10.2.2.1 Wiring and Conduit:
 - 10.2.2.1.1 By Electrical Trade:
 - 10.2.2.1.2 All power supply wiring to mechanical equipment.
 - 10.2.2.1.3 All power supply wiring and conduit to main control panels.
 - 10.2.2.1.4 By Mechanical Trade:
 - 10.2.2.1.5 All control system low voltage wiring.

- 10.2.2.1.6 Conduits for control wiring and components associated with the mechanical work. All low and line voltage control wiring shall be in EMT conduit in accordance with Electrical specifications.
- 10.2.2.1.7 All low and line voltage control wiring and conduit for specified motor interlocks.
- 10.2.2.1.8 Power wiring from electrical panel to control transformers distributed around the building.
- 10.2.2.2 Components:
 - 10.2.2.2.1 By Electrical Trade:
 - 10.2.2.2.2 All disconnect switches except as specified in Mechanical Equipment Schedules.
 - 10.2.2.2.3 All motor protection switches, magnetic starters and contactors.
 - 10.2.2.2.4 All line voltage relays to power and control mechanical equipment.
 - 10.2.2.2.5 By Mechanical Trade:
 - 10.2.2.2.6 All temperature control systems components and packaged equipment controls, relays and transformers.
 - 10.2.2.2.7 All disconnect switches, relays, transformers as specified in Mechanical Equipment Schedules.
 - 10.2.2.2.8 All thermostats, dampers, damper motors, timer clocks and control panels.
 - 10.2.2.2.9 All low voltage transformers to power mechanical equipment controls.
 - 10.2.2.2.10 All power wiring (120 V/1 Ph) to controls transformers, control panels and control devices requiring 120 V/1 Ph power wiring (infrared flush meters etc.).
- 10.2.2.3 Minimum Wiring Requirements:
 - 10.2.2.3.1 All exposed wiring and wiring located above removable, acoustic ceiling tiles shall be run in plenum rated, 18 gauge, two wire, twisted, shielded pair. Two wire twisted pair shall be acceptable for sensor wiring or output; coaxial cable shall be acceptable for transmission wiring. Plenum rated wiring not in EMT conduit shall be run neatly bunched in J-hooks in a rectilinear fashion, running parallel to building. Cable lines must be run at least 12" (300 mm) above ceiling. Where controls cables and wiring are run through, or in "exposed ceilings" such as corridors, all wiring and cables shall be run in conduit. Where permission has been gained to run in a cable tray, only then can conduit be deleted, except for branches from the cable and individual run-outs.

- 10.2.2.3.2 Alternating current wiring over 24 V, both line and low voltage, shall not be run in the same conduit or cable with direct current signals. Direct current signals include communications wiring, analog input wiring, digital input wiring and analog output wiring. 24 V AC and 0-10 V DC may be run together.
- 10.2.2.3.3 Line voltage power or switched power wiring - #12 gauge copper wire minimum.
- 10.2.2.3.4 Line voltage control wiring - #14 gauge copper wire, length not to exceed 50 meters; #12 gauge copper wire, lengths exceeding 50 meters.
- 10.2.2.3.5 Low voltage - wire as directed by applicable electrical codes and requirements but minimum #20 gauge.
- 10.2.2.3.6 Under no circumstances shall the Mechanical Controls Trade run controls cabling or wiring in the Electrical cable tray system without prior written permission from the Electrical Consultant and the Electrical Contractor. Unless otherwise agreed or directed, all control cabling and wiring shall be run independently in conduits and/or separate raceways to be provided by the Controls Trade for their own use.

10.2.3 VARIABLE FREQUENCY DRIVES (VFD)

- 10.2.3.1 The existing evaporative condenser fan VFD is to be reused. Any new VFDs shall meet the following requirements.
- 10.2.3.2 Acceptable VFD manufacturers include Danfoss and ABB. Substitutions are to be approved by the Consultant and must be equivalent with respect to options, functionality, quality, and control system integration.
 - 10.2.3.2.1 VFD shall have a digital start signal and an analog speed signal.
 - 10.2.3.2.2 VFD shall be provided with bypass contactors unless specified otherwise.
 - 10.2.3.2.3 VFD shall include a NEMA 1 enclosure, load reactors, drive fusing and disconnect switch.
 - 10.2.3.2.4 VFD for motors greater than 10HP(7.5kW), shall be provided with passive harmonic filters to limit the total harmonic distortion from the VFD to 5%.
- 10.2.3.3 Passive harmonic filters shall consist of an inductive-capacitive network in parallel with the load.
- 10.2.3.4 Passive harmonic filters shall be complete with capacitor disconnects that shall automatically disengage the capacitors if the motor is not running or lightly loaded (less than 30% loading).

10.2.4 CURRENT TRANSDUCERS

- 10.2.4.1 Current transmitters shall be sized to measure the entire operating current range of the electrical load they are controlling.

10.3 EXECUTION

10.3.1 CONTROL SYSTEM

- 10.3.1.1 It is the responsibility of the Contractor to integrate all new equipment, VFD, sensors, and electronic valves.

10.3.2 GRAPHICS PACKAGE

- 10.3.2.1 The Contractor must update all existing graphics to accommodate the new equipment which has been installed.
- 10.3.2.2 The Contractor shall make changes to the operating code and graphics package, per the direction of the Owner's Representative and the Consultant, for 6 months after the agreed upon start-up date at no charge to the Owner or the Consultant.
- 10.3.2.3 The graphics package and code required to operate the controls must be provided on a USB drive to the Owner at the end of the project.

10.3.3 INSTALLATION

- 10.3.3.1 All sensors, wiring, and mounting locations shall be installed per the controls section of the detailed design drawings.
- 10.3.3.2 CTs will be installed on all mechanical loads above 5 hp to allow for energy modeling.
- 10.3.3.3 As-built controls drawings, both in hardcopy size Arch D format and as a PDF, must be provided to the Owner upon completion of the project.
- 10.3.3.4 Contractor is responsible for furnishing and installation of all electrical components required to integrate the new system and associated hardware with onsite electrical and control equipment.

10.3.4 WIRING

- 10.3.4.1 All wires must be neat and orderly.
- 10.3.4.2 All exposed wires are to be routed in conduit.
- 10.3.4.3 All outdoor wiring and sensors are to be installed in the appropriate NEMA enclosures, conduit, and terminal boxes.

10.3.5 VFDS

- 10.3.5.1 All VFDs will be controlled by a digital start command and a 0 to 10V or 4-20mA signal from the main controls system.
- 10.3.5.2 All VFDs will be installed with BACnet and connected to the existing control system to monitor the output speed, operation frequency, amperage, and start command.
- 10.3.5.3 DV/DT filters are to be used any time a VFD is over 50ft away from the load it is controlling.
- 10.3.5.4 Install VFD in a clean and dry location per the manufacturer's specifications.
- 10.3.5.5 VFDs that can be subjected to splashes or leaks from nearby mechanical equipment must be provided with a suitable NEMA enclosure.
- 10.3.5.6 Integrate VFD with the main controls system.
- 10.3.5.7 Install VFD with load reactors if the wire between the VFD and the load is longer than 50 feet.
- 10.3.5.8 At minimum, install VFD controlling the following items with a bypass:
 - 10.3.5.8.1 Cooling tower and condenser fan motors
 - 10.3.5.8.2 Cooling tower and condenser water pumps

10.3.6 POST INSTALLATION

- 10.3.6.1 After the system has been started, all controls must be adjusted to accommodate observed operating conditions.
- 10.3.6.2 The Contractor must provide a training course detailing the operation, data logging, and recommended maintenance of the controls system. Course time and length are to be appropriate for the complexity of system operation.

10.3.7 TRAINING AND MANUAL

- 10.3.7.1 After the system has been installed and started, the Contractor shall work with the Consultant to provide a training manual and put on a training session regarding the new equipment controls. This training session shall cover the following:
 - Operating methodology
 - Graphic interface
 - Expected operating conditions
 - System trouble shooting
 - Control inputs
 - Physical location of systems

- System safeties

10.3.8 PROGRAMMING

- 10.3.8.1 All control strategies found in the associated drawing package are meant to be used as a guideline for the expected operation of the new equipment. These strategies can be used, however, the Consultant recommends modifying these strategies based on site conditions and commissioning data to ensure optimal performance, as the contractor sees fit. The contractor will be responsible for all final control strategies. All final control strategies are to be approved by the Consultant.
- 10.3.8.2 All final control strategies are to be approved by the Consultant.
- 10.3.8.3 Contractor to provide final control strategies and sequence of operations to Owner following commissioning of DDC system.

END OF SECTION



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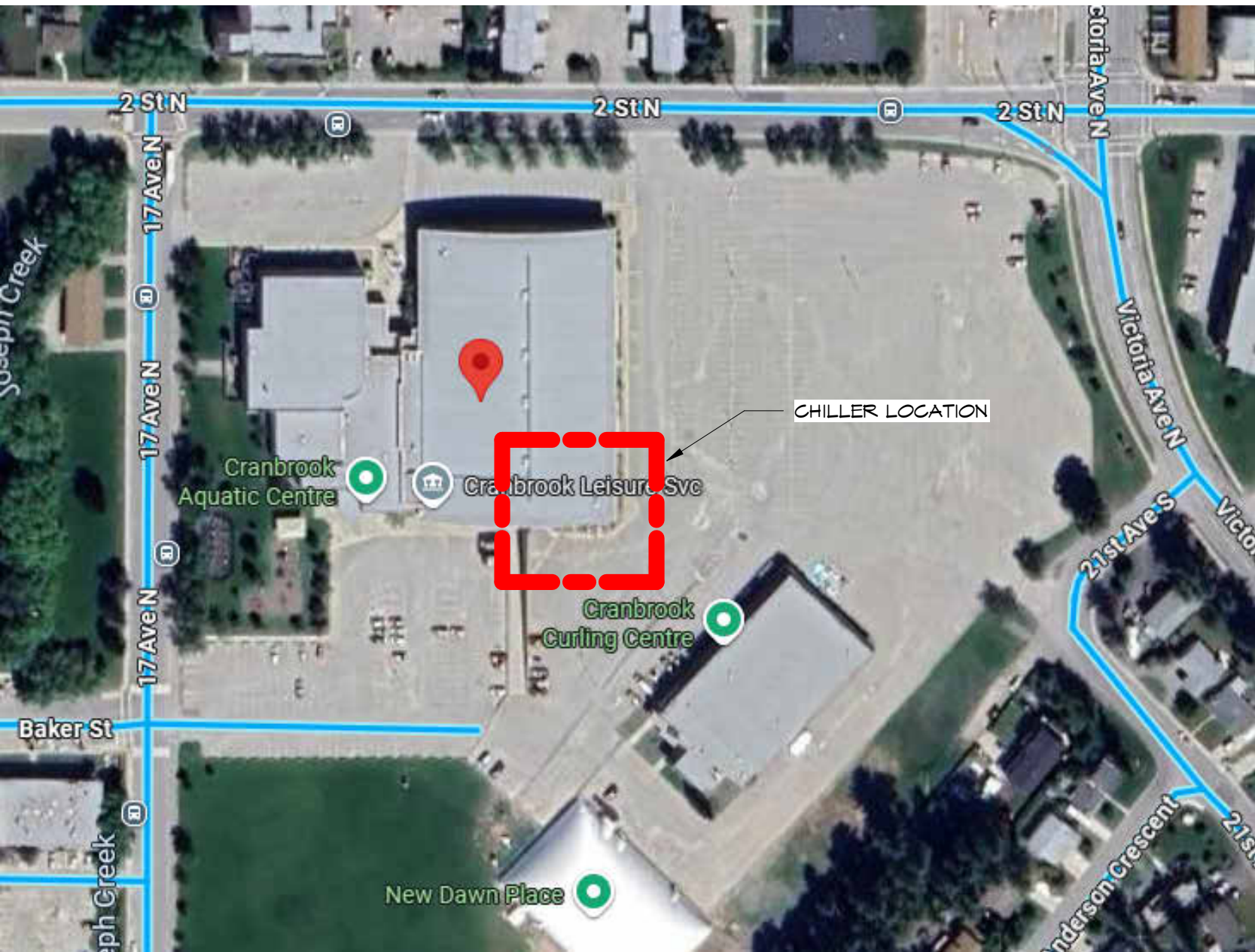
Phone: 403.314.4461
Contact: Dustin Lendvay - Project Manager

ARCHITECTURAL SHEET LIST	
Sheet Number	Sheet Name
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A2.0	SITE PLAN

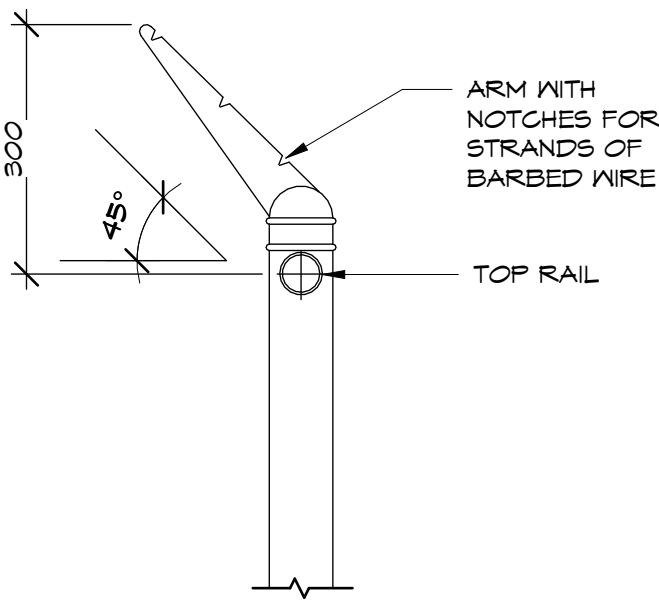
Polar Engineering
722 Cormorant St #300, Victoria, BC V8W 4A5
Phone: 778-700-1086

Contact: Nathaniel Green

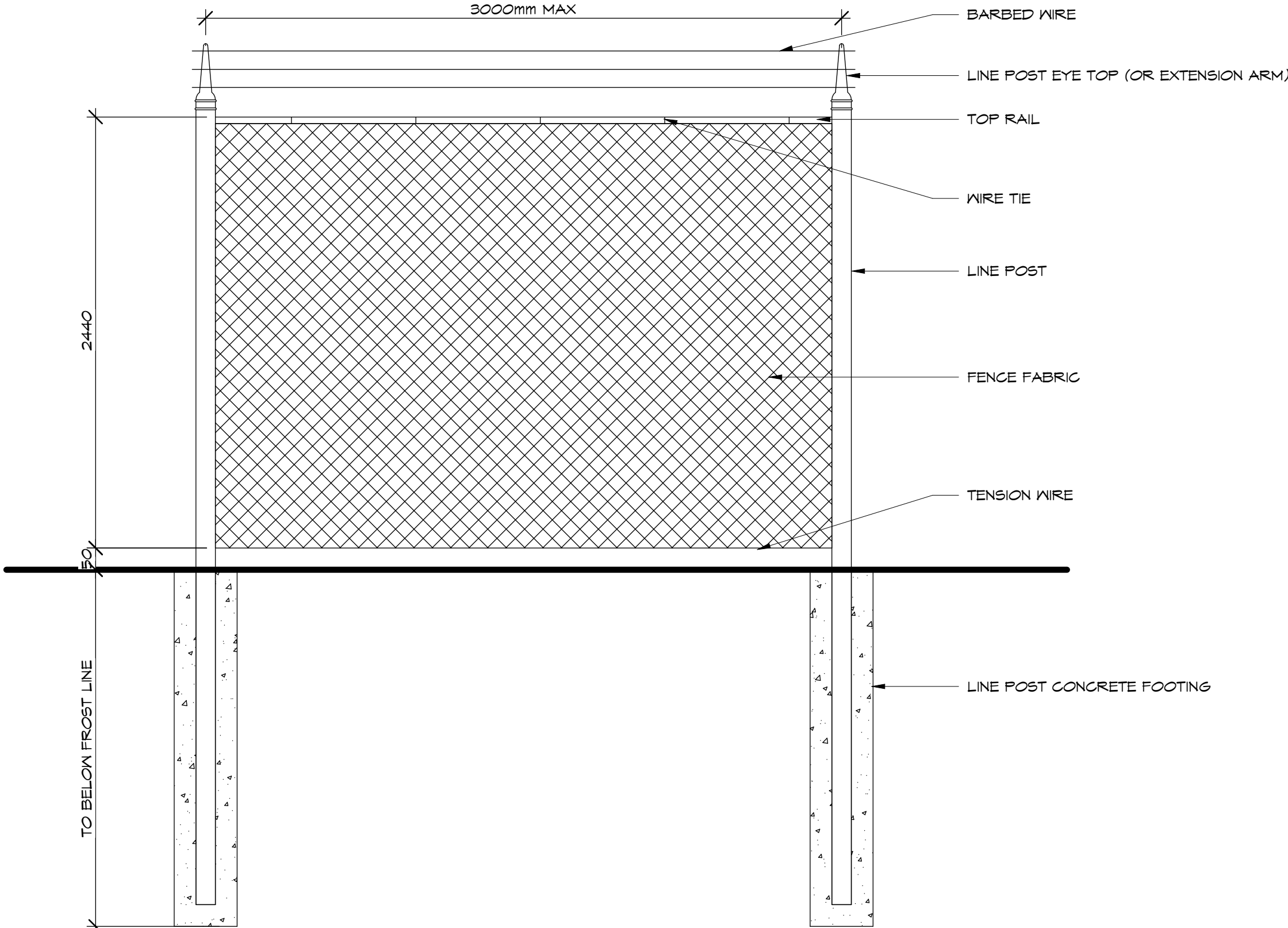
MECHANICAL SHEET LIST	
Sheet Number	Sheet Name
M0	TITLE PAGE
M1	F&I - DEMOLITION
M2	F&I - NEW
M3	DETAILS AND SCHEDULES



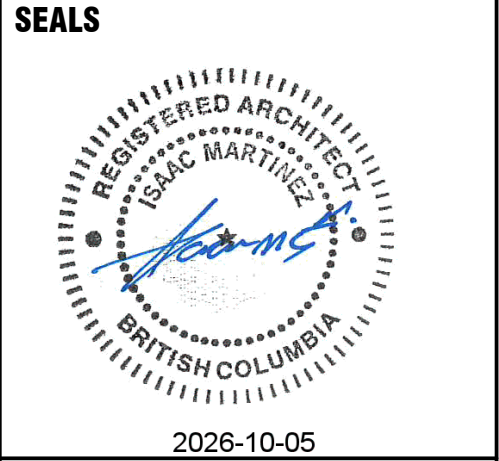
SITE CONTEXT



A3
A0.0
EXTENSION ARM DETAIL
SCALE = 1 : 10



A4
A0.0
CHAINLINK FENCE ELEVATION
SCALE = 1 : 10



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KEY PLAN

REVISIONS + ISSUES	
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PROJECT TITLE
**Western Financial Place
- Evaporative Condenser
Replacement
1777 2 St N
Cranbrook, BC, V1C 3G9**

DRAWING TITLE
TITLE PAGE

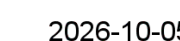
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KEY PLAN

REVISIONS + ISSUES

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PROJECT TITLE
Western Financial Place
- Evaporative Condenser
Replacement
1777 2 St N
Cranbrook, BC, V1C 3G9

DRAWING TITLE

SITE PLAN

SCALE: 1 : 100

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