



REQUEST FOR TENDER

RFT 2026-02

**Watson Lake Recreation Centre
Backup Boiler Project**

Close Date: March 31, 2026

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1 Scope of Requirement

The Town of Watson Lake (the “Town”) is inviting bids for renovations to the existing Watson Lake Recreation Centre Boiler Plant Addition, as described in the attached specifications, prepared by Buildings Systems Consulting Inc. The intent of the work is to correct existing issues with the garage area in compliance with the NBCC and Schedule “T-6 Specifications”.

2 Instructions - RFT Process

2.1 Registration

Registration is required to ensure all potential addenda issued are distributed appropriately. Proponents become registered through MERX or by contacting the Executive Assistant by email to cdo@watsonlake.ca.

2.2 Estimated Timeline

The Town’s intended schedule for awarding the Project is as follows:

Action	Estimated Date*
RFT Release	March 10, 2026
Deadline for inquiries/measurements	March 24, 2026 3:00:00 PM YT
Closing Date and Time	March 31, 2026 3:00:00 PM YT
Award of Contract (Tentative)	April 21, 2026
Project Completion Date	September 30, 2026

**The dates listed above are estimates and the Town reserves the discretion to change any of the above dates.*

2.3 Tender Submission

Proposals must be submitted in a password protected format to cdo@watsonlake.ca. Upon closing an email will be sent requesting the password.

Proposals must be emailed, submitted, and finalized **before 3:00:00 P.M. Yukon Time, Tuesday, March 31, 2026**. Proposals received after this time will not be considered regardless of the reason for being late.

Proposals received by fax, paper delivery or any other method other than what is described above, will not be accepted or considered further for evaluation and will be returned to the Proponent, respectively, upon receipt.

You will receive an email confirmation receipt.

2.4 Inquiries

All inquiries related to this RFT should be directed by email to the following person (the “Town Representative”) on or before **3:00:00 P.M. Yukon Time, Tuesday, March 24, 2026**.

Town Representative: Tiffany Lund, Executive Assistant

E-mail: cdo@watsonlake.ca

Information obtained from any unauthorized source may not be relied upon. Inquiries and responses will be recorded and may be distributed to all Tenderers at the Town's discretion. Tenderers are responsible for checking the RFT and related documents for completeness. Tenderers finding discrepancies or omissions in the Contract or this RFT or having doubts as to the meaning or intent of any provision, should immediately notify the Town Representative. The Town may respond to requests for clarification via email from cdo@watsonlake.ca to the individual bidder or by issuing addenda at any time. However, the Town reserves the right, at its discretion, not to respond to any inquiry or request received, including if the inquiry or request is received without sufficient time before the deadline for inquiries.

If the Town determines that an amendment is required to this RFT, an addendum will be issued in accordance with Section 2.7.

Communications regarding this RFT addressed to the Town that are not received by the Town at cdo@watsonlake.ca, could be cause for disqualification.

2.5 Amendment of Tenders

To complete the submission of the revised forms, the Proponent may upload the revised required forms and Submit and Finalize the submission prior to the Closing Date and Time as identified in Section 2.2.

2.6 Language

Tenders should be in English. The Town reserves the right to not review any portion of a Tender that is not written in English.

2.7 Addenda

Addenda are the only means by which the Town will vary or change any of the information contained in this RFT. The Town reserves the right to issue addenda at any time prior to the Closing Time. The Closing Time may be changed by the Town by an addendum at any time prior to the Closing Time, for any reason.

If the Town determines that an amendment to this RFT is required, the addendum will be emailed to all registered proponents.

Bidders are responsible for ensuring all addenda have been received. Addenda issued will form part of this RFT. No amendment of any kind to this RFT is effective unless it is contained in a formal written addendum issued by the Town Representative. No oral conversations or representations from the Town Representative or any other person will affect or modify any provision of this RFT or may be relied upon by any Bidder.

T-3 SCHEDULE OF ADDENDA should be filled out and submitted with the Tender.

2.8 Contract Award

The Tender submitted will form the basis of a contract between the Town of Watson Lake and the successful tenderer. The successful tenderer will be required to execute the Contract in accordance with these Documents.

2.9 Period of Contract:

The Period of the contract shall commence on the date of issuance of a Purchase Order and shall end on the expiration of the warranty period of the work.

2.10 Termination of Contract

Any resultant contract may be terminated by the Town if the product/service/work is not as tendered or otherwise agreed by the CAO or authorized personnel in writing. In the event the contract must be terminated, the Town reserves the right to exercise all available remedies including, but not limited to, the recovery of incidental and consequential damages.

Failure to comply with any conditions may result in the contract cancellation without subsequent cost or liability to the Town of Watson Lake.

2.11 Opening of Bids

The opening of Bids will be closed to the public. Information on Bidder's names and/or prices received may be released at the Town's sole discretion. In the event Bidder's names and/or prices are released, this information may be released in a timely fashion and only to qualifying Bidders after responses are opened and a Contract is awarded to the successful Bidder.

3 Tender Requirements

Tenders should, at a minimum, address the following information requirements:

3.1 Tender Structure

Tenders should be submitted on the forms provided in this RFT package and should be free of any and all escalation clauses, qualifications or other additions or deletions.

All Tenders should have all spaces, blanks and declarations completed. Any item missed or any special conditions added to the Tender may be cause for its rejection by the Town's sole discretion.

3.2 Corporate Signatures and Authorizations

The Tenderer's legal status as a corporation, partnership or proprietorship should be indicated.

- a) If the Tenderer is a corporation:
 - the Tenderer should print or type the full name of the corporation in the signature section;
 - the names, addresses and titles of all corporate officers should be inserted where indicated;
 - the Tender must be signed by the duly authorized officers of the corporation and the title of those officers should be inserted;
 - the corporate seal should be affixed or impressed.
- b) If the Tenderer is a partnership:
 - the Tenderer should print or type the firm name or business name in the signature section;
 - the full names, addresses and titles of each partner should be inserted where indicated;
 - all named partners must sign the Tender form on behalf of the Tenderer and should affix their seals.
- c) If the Tenderer is a sole proprietorship:

- the firm name and name of the sole proprietor should be inserted in the Tender form;
- the sole proprietor must sign the Tender form and should affix their seal.

All signatures should be witnessed, and the witness should sign where indicated, print or type the name and address of the witness.

4 Special Requirements

Special requirements given below must be fulfilled.

4.1 Specifications

For detailed specifications please see attached Schedule "T-6 Specifications"

4.2 Pricing

Bids received will be evaluated based on compliance with the instructions to bidders and specifications attached hereto, and on tender price as presented in **Schedule T-1**.

As a condition, pricing shall include all related costs associated with executing the Contract. These costs shall include, but are not limited to, freight, duty (if applicable), taxes, warranties, etc., for delivery to Watson Lake, Yukon.

All tenders shall be signed and executed by an authorized representative of the bidding organization. **T-1 Schedule of Quantities and Prices must be completed and submitted by the bidder.**

The Town reserves the right to add, delete, or change any items of this tender prior to the date of issuing a purchase order. Any additions, deletions, or changes of product (quantity, size, delivery, etc.) noted and separately priced in the tender submission shall be at the pricing tendered and any others not covered in these tender documents shall be at a price to be negotiated and mutually agreed upon by both parties.

4.3 Delivery

Guaranteed availability and satisfaction should be considered a **condition** of the specifications for this tender. The Town requests the successful bidder to supply and deliver the equipment as tendered.

4.4 Inspection and Testing

The Town of Watson Lake reserves the right to inspect and/or test the Deliverables supplied under the Contract prior to final acceptance by the Town of Watson Lake.

5 Tender Evaluation

Bidders acknowledge and accept, by way of bidding, that the Town's evaluation of tender pricing shall be based on the "**TOTAL TENDER PRICE**", as presented in Schedule T-1, including any and all Provisional Items including Warranty and Repair information provided. During the assembly of Contract Documents the Town may, at its sole and absolute discretion, include any or all Provisional cost items in the total contract price. Furthermore, all bidders acknowledge that the subsequent performance of any or all of the awarded provisional items, which have been included in any executed contract, shall be realized **ONLY** upon the written request of the designated officer and that such authorization remains at their sole and absolute

discretion.

The Town will not necessarily accept the lowest or any Tender and reserves the right to accept or reject any or all Tenders, or to accept the Tender which the Town deems to be in its own best interest.

Without limiting the generality of the foregoing, any Tender may be rejected for:

- a) incomplete Tender;
- b) conditional Tender;
- c) obscured/irregular erasures or corrections in Schedule of Quantities and Prices;
- d) prices omitted;
- e) unbalanced bid;
- f) evidence of inadequate experience or of inadequate capacity to perform the Work;
- g) evidence of previous failure to perform adequately on similar work or be able to provide the deliverables as per specifications;
- h) evidence of alterations to the electronic Tender Form.

Any significant items omitted from the tender or any additions, alterations, conditions, or qualifications added to the tender, or failure to properly sign the tender, may cause the bid to be rejected. A tender may be rejected where there is substantial evidence that, according to the evaluation criteria set out above, the bidder would be unable to carry out the work required. The determination of whether to reject any tender or to remove any tender from the evaluation process will be made in the absolute discretion of the Town.

Whenever alternatives are accepted, the Tenderer shall be responsible for making all consequential adjustments to make the alternative fit into the Work as specified, and any consequential costs shall be deemed to be included in the price tendered for the Alternative Proposal.

6 RFT General Terms & Conditions

6.1 General

By submitting a Tender, a Tenderer agrees that, upon Tender Acceptance, the Tenderer, if selected as the Preferred Tenderer, will execute the Contract. The Preferred Tenderer's Tender, or any portion thereof, may form part of the Contract at the Town's discretion.

6.2 Irrevocable

All tenders are irrevocable for and open for acceptance for a period of sixty (60) days from Tender Closing or until a Contract is signed with the Successful Bidder(s), whichever comes first.

6.3 No Obligation

This RFT does not commit the Town in any way to select a Preferred Tenderer, or to proceed to negotiations for a Contract, or to award a Contract. The Town reserves the right to at any time for any reason reject all Tenders, terminate this RFT, and proceed with the Project in some other manner. The lowest or any quotation or tender shall not necessarily be accepted.

6.4 Reservation of Rights

Notwithstanding any other section of this RFT or any practice or custom of the trade or industry, the Town, in its discretion, reserves the complete right to, at any time and from time to time, do any or all of the following:

- accept any Tender;
- disqualify a Tenderer from this RFT;
- reject any Tender for any reason, including without limitation if in the Town's view the Tenderer or its proposed subcontractors do not have sufficient experience performing services similar to the Services;
- reject all Tenders for any reason, terminate this RFT process and, if the Town elects, obtain or proceed with the Project in some other manner, including by conducting a new procurement process;
- accept a Tender which is not the lowest cost Tender even if the lowest cost Tender conforms in all respects with the requirements set out in this RFT;
- accept a Tender that does not comply with the specifications set out in the Contract;
- reject a Tender even if it is the only Tender received by the Town;
- not proceed to review and evaluate, or discontinue the evaluation of, any Tender;
- receive further information from any Tenderer or refuse to receive further information from any Tenderer;
- negotiate the Contract and other terms with any Tenderer;
- award a Contract to whomever the Town in its discretion deems appropriate and in the best interest of the Town; and
- object to a proposed subcontractor for reasonable cause, in which case the Town will permit a Tenderer to propose a substitute subcontractor acceptable to the Town.

The Town may, in its discretion, reject any Tender which fails to conform to or includes qualifications to the requirements of this RFT, which is materially incomplete, obscure, or irregular, which contains exceptions or variations, or which omits any material information required to be submitted. Notwithstanding anything to the contrary in this RFT, the Town may in its discretion (and if it is deemed to be in the best interest of the Town) retain any such Tender for consideration and may waive any or all of the foregoing, on such terms and conditions as the Town may consider appropriate, and consider such Tender in the same manner as Tenders that fully conform to the requirements of this RFT without qualification.

6.5 Receipt of Complete RFT

Tenderers are responsible to ensure that they have received the complete RFT, as listed in the table of contents of this RFT, plus any addenda. A submitted Tender will be deemed to have been prepared on the basis of the entire RFT issued prior to the Submission Time, including any addenda. The Town accepts no responsibility for any Tenderer lacking any portion of this RFT. The submission of a Tender constitutes a representation by the Tenderer that it has verified receipt of the complete RFT, including any addenda.

6.6 Examination of RFT and Contract Documents

Tenderers will be deemed to have carefully examined the RFT and any addenda, including all attached appendices and the Contract, prior to preparing and submitting a Tender.

While the Town has used considerable efforts to ensure an accurate representation of information in this RFT, the information contained is supplied solely as a guideline for Tenderers. The information is not guaranteed or warranted to be accurate by the Town, nor is it necessarily comprehensive or exhaustive. Nothing in this RFT is intended to relieve Tenderers from forming their own opinions and conclusions with respect to this RFT.

6.7 End Use of Project

Once the project/work/contract is complete, all reports and documentation produced as well as any information collected will become the property of the Town of Watson Lake.

6.8 No Collusion

Bidders shall not discuss or communicate, in any form, with any other Bidder or any representative or agent of any other Bidder regarding the preparation or presentation of their Bids. Bids shall be submitted without any connection, knowledge, comparison of information, or arrangement, with any other Bidder or any agent or representative of any other Bidder.

If a Bidder contemplates using the same subcontractor or supplier for a particular part of the Deliverables, the Bidder shall put into place appropriate ethical walls and other safeguards to protect the confidentiality of their information and to ensure collusion does not take place.

6.9 Conflict of Interest

Tenderers should disclose any potential conflicts of interest and existing business relationships they may have with the Town. The Town may disqualify any Tenderer that in the Town's opinion:

- has an unfair advantage (including access to any confidential information not available to all Tenderers), whether real, perceived, existing now or likely to arise in the future; or
- would be in a conflict of interest if the Tenderer is awarded a Contract.

By submitting a Tender, a Tenderer warrants that, to the best of its knowledge and belief, no actual or potential conflicts of interest exist with respect to the submission of the Tender, other than as disclosed in the Tender. Where the Town discovers a Tenderer's failure to disclose an actual or potential conflict of interest, the Town may, in addition to any other remedies available, disqualify the Tenderer.

The Town may disqualify a Tenderer if a Town employee is a member of the Tenderer Team, whether as an employee or as a sub-contractor, sub-consultant or specialist.

6.10 Government Approvals

Neither the acceptance of a Tender nor the execution of a Contract will constitute approval of any activity or development contemplated in any Tender or the Contract that requires any approval, permit or license under any federal, territorial, provincial or municipal statute, regulation or by-law.

6.11 Tenderer's Expenses

Tenderers are solely responsible for their own expenses incurred in connection with this RFT, including in preparing and submitting Tenders, and for any meetings, negotiations or discussions with the Town or its representatives and consultants.

6.12 No Claims

By submitting a Tender, each Tenderer agrees that the Town and its employees, advisors, and representatives will not under any circumstances be liable for any claims, whether for costs, expenses, losses or damages, or loss of anticipated profits, or for any other matter whatsoever, incurred by the Tenderer in preparing and submitting a Tender, participating in this RFT process or other activity related to or arising out of this RFT process, including if the Town for any reason cancels this RFT process, rejects any or all Tenders, fails to identify or correct a discrepancy in a Tenderer's proposed pricing, accepts any compliant or non-compliant Tender or breaches any duty of fairness, express or implied term of the Tender documents or other duty to the Tenderer.

6.13 Confidentiality

All Tenders become the property of the Town and will not be returned to the Tenderer. All Tenders will be held in confidence by the Town unless otherwise required by law. Tenderers should be aware that the Town is a "public body" and must comply with access to information legislation under the *Municipal Act* of the Yukon Territory.

By submitting a Tender, the Tenderer represents and warrants to the Town that the Tenderer has complied with applicable laws, including by obtaining from each person any required consents and authorizations to the collection of information relating to such individual and to the submission of such information to the Town and the use, distribution, and disclosure of such information as part of the Tender for the purposes of, or in connection with, this RFT.

6.14 No Solicitation

Tenderers and their directors, officers, employees, agents and other representatives should not engage in any form of lobbying whatsoever to influence the outcome of this RFT or attempt to communicate directly or indirectly with, or make any representation or solicitation to, any director, officer or employee of the Town (except the Town Representative) with respect to this RFT, whether before or after submission of a Tender. If a Tenderer or any of its directors, officers, employees, agents and other representatives contravenes the foregoing, the Town may, in its discretion, terminate that Tenderer's continued participation in this RFT or reject or not accept a Tender from that Tenderer.

6.15 Electronic Communication

The following provisions will apply to any email communications with the Town Representative, or the delivery of documents to the Town Representative by email where such email communications or deliveries are permitted by the terms of this RFT:

- the Town does not assume any risk or responsibility or liability whatsoever to any Tenderer:
 - i) for ensuring that any electronic email system being operated for the Town is in good working order, able to receive transmissions, or not engaged in receiving other transmissions such that a Tenderer's transmission cannot be received; or

- ii) if a permitted email communication or delivery is not received by the Town, or received in less than its entirety, within any time limit specified by this RFT; and
- iii) all permitted email communications with, or delivery of documents by email to, the Town Representative will be deemed as having been received by the Town Representative on the date and times indicated on the Town Representative's electronic equipment.

6.16 No Promotion

The Contractor will not disclose or promote its relationship with the Town, including by means of any verbal declarations or announcements and by means of any sales, marketing or other literature, letters, client lists, press releases, brochures, or other written materials, without the express written consent of the Town.

6.17 Invoicing and Payment

The Successful Tenderer should direct all invoices to Town of Watson Lake, Accounts Payable. Invoices should be submitted electronically in pdf format to cao@watsonlake.ca and include the following in the subject line:

- Town Purchase Order Number
- Invoice Number

The Contractor shall include a valid Town purchase order number which will be issued upon contract award. Payment terms will be thirty (30) days.

- All invoices shall include the following information:
- Contractor's name/Address;
- Date of Invoice;
- Invoice Number;
- Current and applicable Town Purchase Order Number;
- Invoice period (e.g. November 01 – November 30, 2026);
- GST shown separately and the GST registration number

Any contract entered into will be subject to, (have included), payment terms provided all terms and conditions on the part of the successful Tenderer have been complied with, for payment of each invoice or progress payment within 30 calendar days after receipt of the invoice, or 30 calendar days after delivery of goods or services whichever is later.

New vendors to the Town will be provided with the necessary documents to facilitate electronic funds transfer.

All payments shall be processed using electronic funds transfer which shall be deposited directly to the Contractors bank account. If any alternative from the accepted method of payment is necessary, such alternative shall be mutually agreed upon and confirmed in writing by both the Contractor and the Town.

6.18 Incomplete Tenders and Errors

The Town may request clarification where, in the opinion of the Town, the Tender is incomplete or unclear. For unit price items, the unit price will govern. If an error is discovered in the calculated total price for a unit price item, based on the extension of the unit price by the estimated quantities in the Schedule of Prices, or based on the addition of GST, then the total price may be revised by the Town to the correct amount based on the unit price and estimated quantity, or GST amounts.

6.19 Insurance

- a. Contractor shall provide Certificates of Insurance prior to starting work.
- b. The Contractor shall provide and maintain, either by way of a separate policy or by an endorsement to its existing policy, Comprehensive General Liability Insurance acceptable to the Town and subject to limits of not less than three million dollars (\$3,000,000.00) inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof.
- c. Where the Contractor's current Insurance policy fails to provide adequate coverage, such policy may be combined with an Umbrella or excess Liability Policy to provide the necessary coverage.
- d. The Contractor shall provide and maintain Automobile Liability Insurance, in a form acceptable to the Town, in respect of all licensed vehicles owned, leased or rented by the Contractor subject to limits of not less than three million dollars (\$3,000,000.00) inclusive per occurrence.
- e. Insurance shall be maintained continuously until the delivery and acceptance of the equipment as tendered.

6.20 Warranty

The Supplier shall be required to warrant the equipment, providing protection against defects in material and workmanship.

Where applicable, when the manufacturer provides a longer warranty period that is more extensive in nature, then the provisions of such manufacturer's warranty shall apply.

The warranty period shall commence from the "in service date", which is the date that the Project is deemed to be complete.

T-1 Schedule of Bid

THIS SCHEDULE MUST BE COMPLETED AND INCLUDED IN TENDER SUBMISSION

All prices submitted shall be in Canadian dollars (CAD) and shall include all applicable costs including delivery DAP (Delivered At Place) to the Town of Watson Lake, except the GST, and duty (if applicable), which shall be shown separately. The **Bid Price** shall include all costs, including, but not limited to, the supply of all labour, materials, equipment, and services necessary for the execution and completion of the Project, in accordance with the Tender Documents, and no additional costs will be chargeable to the Town unless indicated below.

If a sub-total or total amount is indicated, and a price has not been entered for any payment items that forms part of the sub-total or total amount, that payment item shall be deemed to have been included in the other prices that make up the sub-total or total price(s), as applicable.

Bid Price	\$	(CAD)
GST	\$	(CAD)
Duty (if applicable)	\$	(CAD)
TOTAL	\$	(CAD)

TOTAL TENDER PRICE INCLUDES DELIVERY TO:

Watson Lake Recreation Centre, 912 Lakeview Avenue, Watson Lake, Yukon.

T-2 Schedule of Sub-Contractors

THIS SCHEDULE MUST BE COMPLETED AND INCLUDED IN TENDER SUBMISSION

The Contractor states that the following names of Sub-Contractors are intended to be used to execute the Project:

Trade or Item of Work	Name of Sub-Contractor

T-3 Schedule of Addenda

THIS SCHEDULE SHOULD BE COMPLETED AND INCLUDED IN THE SUBMISSION OF A BID

The Contractor states that the following Addenda have been received and have been considered and taken into account in determining the Prices in the Schedule of Quantities and Prices. Note: If no Addenda are issued, indicate N/A on the first line

Addendum Number	Date Issued	Number of of Pages
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

T-4 Schedule of Qualifications/References

THIS SCHEDULE SHOULD BE COMPLETED AND INCLUDED IN THE TENDER SUBMISSION

The Bidder is to provide financial and business references below:

Financial Reference

Bank _____

Contact Person _____

Telephone Number _____

Business References

Product Supplied _____

Company Name _____

Contact Person _____

Telephone Number _____

Product Supplied _____

Company Name _____

Contact Person _____

Telephone Number _____

Product Supplied _____

Company Name _____

Contact Person _____

Telephone Number _____

T-5 Schedule of Signatures

THIS SCHEDULE MUST BE COMPLETED AND INCLUDED IN THE TENDER SUBMISSION

Name of Contractor/Corporation **(PLEASE PRINT)**

Legal Status: Corporation, Partnership, or Sole Ownership **(PLEASE PRINT)**

Mailing Address **(PLEASE PRINT)**

Telephone Number

Fax Number

Email Address

Names and Addresses of Corporation Officer or Members of the Organization:

Name

Address

Title

Name

Address

Title

Name

Address

Title

By signing below I/we accept all terms and conditions of this Request for Tender and acknowledge that we have received and taken into consideration all addenda issued in our submitted bid.

Signature by Authorized Representative: _____

Name of Representative **(PLEASE PRINT)**

(Corporate Seal Here)

Title of Representative **(PLEASE PRINT)**

Signature of Witness: _____

Name of Witness **(PLEASE PRINT)**

Address of Witness **(PLEASE PRINT)**

Date

T-6 Schedule of Specifications

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**Watson Lake Rec Centre – Boiler
Plant Addition**

PROJECT SPECIFICATIONS

Issued for Tender



Building Systems Consulting

Project: 2023-086

February 18, 2025

**PROJECT SPECIFICATION
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1 General

1.1 PROJECT TITLE

Recreation Centre Backup Boiler Project Watson Lake, YT

BSC Project Reference: 2023-086

Prepared for:



Town of Watson Lake

Prepared by:



Building Systems Consulting
Unit 20 1114 Front Street
Whitehorse, YT
Y1A 1A3

Submission: **Issued for Tender**
January 16, 2026

END OF SECTION

1.1 GENERAL

.1 Section Includes

.1 Hereinafter the signed and dated professional seals of the supervising Mechanical Engineer and the corporate Permits to Practice for the Territory of the project.

1.2 MECHANICAL ENGINEER OF RECORD

Building Systems Consulting
Unit 20 1114 Front Street
Whitehorse, YT
Y1A 1A3

Jeffrey Pike, P.Eng

Licence 2302

Permit No PP725

1.3 ELECTRICAL ENGINEER OF RECORD

Building Systems Consulting
Unit 20 1114 Front Street
Whitehorse, YT
Y1A 1A3

Adam Behiels, P.Eng

Licence No 3741

Permit No PP725

1.4 ARCHITECT OF RECORD

Kobayashi and Zedda Architects
Unit 26 1114 Front Street
Whitehorse, YT
Y1A 1A3

Ryan McLennan, AIBC

Licence No _____

Permit No _____

END OF SECTION

1 General

1.1 SECTION INCLUDES

1. Hereinafter are the lists of the drawings which have been issued and are to be included as part of the Tender Documents and the Contract Documents.
2. Drawing sheet numbers and descriptions noted by Grey Text Font indicate drawing sheets which have not been included in this submission package.

1.2 MECHANICAL DRAWINGS

Sheet No. Description

M00	Site Plan, Mechanical Legend and Drawing List
M01	Heating and Propane Schematic
M02	Demolition Plan and Details
M03	Mechanical Room Plan
M04	Mechanical Section Views

1.3 ELECTRICAL DRAWINGS

Sheet No. Description

E001	Electrical Cover Sheet, Legend
E100	Electrical Legend, Site Plan, Details, & Mechanical Schedule
E300	Demolition Plan, Power Layout, & Details
E600	Panelboard Schedules

1.3 ARCHITECTURAL DRAWINGS

Sheet No. Description

A1.01	Renovation Floor Plan & Details
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END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises renovations to the existing garage bay, as described in the attached drawings and specifications.
- .2 The intent of the Work is to correct existing issues with the garage area compliance with the NBCC.
- .3 Work includes, but is not limited to the following:
 - .1 A new boiler/mechanical room
 - .2 Provision of new propane fuel system with connection to new propane tank by owner. Contractor to provide piping, distribution system, regulators, vehicle protection and foundation/restraint systems.
 - .3 Installation of new boiler plant including pumps, heat exchangers and vents.
 - .4 Modifications to roofing and provision of new roofing curb to facilitate vent installation.
 - .5 Site works including landscaping, patchwork and repair of disturbed landscape features.
 - .6 Provision of new valves, gaskets/couplers and control valves on hydronic distribution piping as shown.
 - .7 Balancing of the new and modified hydronic equipment
 - .8 All mechanical, and electrical work shown on drawings and described in specifications.
 - .9 O&M manuals and as-built drawings.
 - .10 Co-ordination of sub-contractors.
 - .11 Liaison with Owner and Consultant.
 - .12 Securing and paying for all fees and permits as required by the Authorities Having Jurisdiction as required to complete the Work.
 - .13 Mobilization and demobilization costs.
 - .14 Dumpster, construction fencing, and coordination of all rental costs (including all heavy and light equipment).
 - .15 Coordination and management of all staging areas.
 - .16 Site cleanliness, including progressive cleaning.
 - .17 Management of hazardous materials as identified in the included reporting.

1.2 COMPLETION DATE

- .1 The Contractor must achieve Substantial Performance as per contract documents.

- .2 Heating System upgrades must be complete and fully operation by September 31st, 2026 to ensure facility operation is not affected by this work.
- .3 Outstanding deficiencies and/or work not related to the heating system operation can be extended past the Sept. 31st deadline at the approval of the Consultant. Where this work is anticipated to extend, notify the Consultant in writing a minimum 4 weeks in advance and indicated on the submitted project schedule.

1.3 WORK SEQUENCE

- .1 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.
- .2 Construct Work in stages to ensure all areas of the building remain useable to the owner. No part of the envelope is to be removed which cannot be replaced and can be made watertight under climatic conditions existing at the time.
- .3 Maintain fire fighters access/control.

1.4 SEISMIC DESIGN REQUIREMENTS

- .1 Design building components, assemblies and systems of the Work, as applicable, to meet seismic requirements pertinent to the location of the Place of the Work in accordance with the building code and comply with requirements of jurisdictional authorities.
- .2 Vibrating equipment shall receive seismically designed vibration isolation. Only nonvibrating equipment are permitted to be secured to the structure. Structural connection shall be by means of direct connection to the structure by bolting, using rigid seismic restraints, or taught cable restraints. Connection to structure shall occur only at locations capable of withstanding the forces applied.
- .3 The proposed connections and general design of Products, equipment and systems shall be described in shop drawing format with identification and location of forces imposed on the structure. The shop drawings shall be stamped by a Professional Engineer licensed to practice in the Place of the Work and have the appropriate understanding of the issues at hand. The shop drawings shall be submitted for review to the Consultant prior to putting the work in hand. The Consultant shall review these shop drawings for loads imposed on the structure.
- .4 Professional Engineer responsible for preparation of seismic engineered submittal shall review the Work and shall submit Letters of Assurance for those parts of the Work in accordance with engineered submittal requirements of Section 01 33 00.

1.5 REQUESTS FOR INFORMATION

- .1 Submit RFI on a standardized "Request for Information" form. The Consultant shall not respond to an RFI except as submitted on a form.

- .2 Where RFI form does not provide sufficient space for complete information to be provided thereon, attach additional sheets as required.
- .3 Submit with RFI form necessary supporting documentation.
- .4 Submit RFIs sufficiently in advance of affected parts of the Work so as not to cause delay in the performance of the Work. Costs resulting from failure to do this will not be paid by the Owner.
- .5 Number RFIs consecutively in one sequence in order submitted.
- .6 Submit one distinct RFI per RFI form.
- .7 Maintain log of RFIs sent to and responses received from the Consultant, complete with corresponding dates.
- .8 Consultant shall review RFIs from the Contractor submitted in accordance with this section, with the following understandings:
 - .1 Consultant's response shall not be considered as a Change Order or Change Directive, nor does it authorize changes in the Contract Price or Contract Time or changes in the Work.
 - .2 Only the Consultant shall respond to RFIs. Responses to RFIs received from entities other than the Consultant shall not be considered.
- .9 Allow 5 Working Days for review and initial response to each RFI by the Consultant.

1.6 PROJECT MEETINGS

- .1 Refer to Section 01 31 19 – Project Meetings

1.7 WORK SCHEDULE

- .1 On award of contract submit a critical path method (CPM) gantt chart construction schedule for the work, indicating anticipated progress stages within time of completion.
- .2 Minimum stages include:
 - .1 Mobilization,
 - .2 Shop drawings, Product data MSDS sheets and samples submittal,
 - .3 Order and delivery of major components and equipment,
 - .4 Major approvals stages,
 - .5 Interim and final inspection times,
 - .6 Commissioning timeframes,
 - .7 Final deficiency corrections,
 - .8 Training,
 - .9 Demobilization,
 - .10 Close-out manuals submission.

- .3 Clearly show sequence and interdependence of construction activities and indicate:
 - .1 Start and completion of all items of Work, their major components, and interim milestone completion dates.
 - .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
 - .1 Time for submittals, resubmittals and review.
 - .2 Time for fabrication and delivery of manufactured products for Work.
 - .3 Interdependence of procurement and construction activities.
 - .3 Include sufficient detail to assure adequate planning and execution of Work. Activities generally range in duration from 3 to 15 work days each.
- .4 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow co-ordination and control of project activities. Show continuous flow from left to right.
- .5 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as indication of increased risk.
- .6 Insert Change Orders in appropriate and logical location of Detail Schedule. After analysis, clearly state and report to Consultant for review effects created by insertion of new Change Order.
- .7 When schedule has been reviewed and approved by the Departmental Representative take necessary measures to complete work within scheduled times. Do not change schedule without written approvals from the Departmental Representative.
- .8 Project schedule reporting:
 - .1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.
 - .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.
 - .3 Ensure project schedule efficiencies through monitoring of project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.
 - .4 Monitor sufficiently often so that causes of delays can immediately be identified and mitigated.

1.8 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises for Work, for storage, and for access, to allow:
 - .1 Owner occupancy.
 - .2 Public usage.
- .2 Co-ordinate use of premises under direction of the Owner and building occupants.
- .3 Do not unreasonably encumber site, with material or equipment.
- .4 Execute the work with the least possible interference or disturbance to the normal use of the exiting premises. Make arrangements with the Departmental Representative to facilitate the work as stated.
- .5 Maintain existing services to the building and provide for personnel and vehicle access.
- .6 All parts of the building are to remain watertight. No openings are to be made which cannot be protected and made watertight under climatic conditions existing at the time.
- .7 Access to building roofs is to be confirmed by the Departmental Representative.
- .8 Maintain a solid or chain link, or construction security fence c/w suitable locks around storage areas at all times.
- .9 Where security is reduced by the work, provide temporary means to maintain security.
- .10 Contractor to supply their own site trailer (if required) phone, fax, and storage box. No storage will be provided within the building. Accommodation will be made for limited on-site storage at the discretion of the Departmental Representative in area designated by the Departmental Representative.
- .11 The Departmental Representative will assign sanitary facilities for use by the Contractor's work force. Keep area and premises in sanitary condition.
- .12 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .13 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .14 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Consultant.
- .15 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.9 UTILITIES

- .1 Water supply can be coordinated with owner but in no circumstance shall abnormal water usage or waste be discharged to sanitary.
- .2 Existing electrical services to a maximum of 15 kVA required for the work may be used by the Contractor without charge. Ensure capacity is adequate prior to connecting and imposing additional loads. Connect and disconnect at own expense and responsibility.

1.10 OWNER OCCUPANCY

- .1 Owner will occupy the building during entire construction period
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.11 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 Cutting and Patching
 - .1 Cut existing surfaces as required to accommodate new work. Openings shall be neatly cut and dimensioned to fit electrical conduits, mechanical pipes and/or ductwork passing through the surfaces. Obtain the Departmental Representative's approval before cutting into structure. Cutting torches shall not be permitted.
 - .2 Patch and make good cut on both sides of surfaces, damaged or disturbed to match or better existing conditions to the satisfaction of the Departmental Representative.
 - .3 The Contractor shall patch and make good existing openings when Contractor utilizes the existing openings for his work.
- .3 Demolition
 - .1 Except if expressly stated otherwise, materials indicated for removal, become the Contractor's property and shall be promptly taken from the site.

1.12 EXISTING SERVICES

- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by the Departmental Representative. Connection to existing services shall be after hours and/or on weekends.
- .2 Before commencing Work, establish location and extent of service lines in area of Work and notify the Departmental Representative of findings.

- .3 Submit schedule to and obtain approval from the Departmental Representative for any shutdown or closure of active service or Facility. Adhere to approved schedule and provide notice to affected parties. Do not alter schedule without prior written consent of the Departmental Representative.
- .4 Give the Departmental Representative 48 hours notice related to each necessary interruption of any mechanical or electrical service throughout the course of the work. Obtain written authorization from the Departmental Representative prior to any interruption. Keep duration of those interruptions to a minimum.
- .5 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

1.13 CONTRACT DOCUMENTS

- .1 The Contract Documents have been arranged into various divisions, sections, drawings, and schedules in a complementary manner for the purpose of presenting the Work in a logical and organized form and to enable ease of reference and interpretation, and are not intended to be an arrangement of precise and independent Subcontractors, or jurisdiction of responsibility for the various parts of the Work. The Contractor shall be solely responsible for coordinating the execution of the Work of this Contract in accordance with the requirements of the Contract Documents.
- .2 As a result, the Consultant shall not be required to decide on questions arising with regard to agreements or contracts between the Contractor and Subcontractors or Suppliers, nor to the extent of the parts of the Work assigned thereto.
- .3 Further, no extra will be allowed as a result of the failure to coordinate and allocate the Work such that the Work is Provided in accordance with the Contract Documents.
- .4 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

1.14 SPECIFICATIONS

- .1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.
- .2 A division may consist of the Work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the Work rests solely with the Contractor.
- .3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

1.15 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy of each document as follows:
 - .1 Contract Drawings.
 - .2 Contract Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings and samples.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Manufacturers' installation and application instructions
 - .12 One set of record drawings and specifications for "as-built" purposes
 - .13 National Building Code of Canada 2015
 - .14 Current construction standards of workmanship listed in technical Sections
 - .15 Other documents as specified.

1.16 HOURS OF WORK

- .1 Work shall be carried out as follows as per the details outlined in the RFB.
- .2 All noise generating or strong-smelling work to be completed must be coordinated with the Departmental Representative and completed outside of work hours where they will result in distribution to building use.
- .3 The Contractor shall not permit his personnel to work alone on this project when the following activities are undertaken:
 - .1 Work assessment determined that the potential health & safety risk is high;
 - .2 Work requiring entry into or work within a Confined Space;
 - .3 Work requiring use of fall arrest equipment;
 - .4 Work on scaffolding;
 - .5 Work requiring supplied air respirators or similar equipment;
 - .6 Work involving cranes or hoisting;
 - .7 Work or work situations identified by the Departmental Representative.

1.17 BUILDING SMOKING ENVIRONMENT

- .1 Smoking is prohibited on the property. Obey smoking restrictions on building property as directed by the Owner.

1.18 PAYMENT PROCEDURES

- .1 Submit to Departmental Representative, at least 15 days before the first application for payment, a Schedule of Values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment. After approval, it will be used as the basis for progress payments.
- .2 Include updated project schedule with each application for payment. Consultant will not review application unless an updated schedule is provided. Refer to GC5.3 of the CCDC-2 contract for further requirements and details
- .3 Prior to submitting application for substantial performance of the Work, Prepare and submit to Departmental Representative comprehensive list of items to be completed or corrected and apply for a review by Consultant to establish Substantial Performance of Work. Failure to include items on list does not alter responsibility to complete Contract. Refer to GC5.3 of the CCDC-2 contract for further requirements and details

1.19 SUBMITTALS

- .1 Refer to Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings
 - .1 Provide an electronic copy of the shop drawings as listed in the specifications and/or drawings to the Departmental Representative prior to ordering materials. Shop drawings to illustrate details of portion of work specific to the project requirements. Information to clearly indicate the items to be reviewed. Generic drawings and faxed copies are not acceptable.
 - .2 Allow ten (10) working days for Departmental Representative's review of each shop drawing submission.
- .3 Certificates
 - .1 Submit a completed Notice of Project Form to the Yukon Workers' Compensation Health and Safety Board as required by the notification requirements under the Regulations for Construction Projects made pursuant to the Occupational Health & Safety Regulations. Provide copy to the Departmental Representative.
 - .2 Prior to commencing the work, throughout the total performance of the work when requesting payments and prior to receiving final payment, the Contractor shall provide evidence of good standing with Yukon Workers' Compensation Health and Safety Board.

1.20 CONSTRUCTION SAFETY MEASURES

- .1 Observe and enforce construction safety measures required by the Canada Labour Code Part II, Occupational Health and Safety, Yukon Occupational Health and Safety Act and municipal statutes and authorities and site-specific Health and Safety Policies and Directives

- .2 In the event of conflict between any provisions of above authorities, the most stringent will apply.
- .3 Provide and maintain guardrails, fences, barricades, lights, signs and other devices required for protection of workmen and public in accordance with the requirements of the Canada Labour Code Part II, Occupational Health and Safety, Yukon Occupational Health and Safety Act and Regulations for Construction Projects and Local by-laws. All signs shall be bilingual or CSA universal pictograms.
- .4 Ensure the safety of building personnel at all times when performing work.
- .5 Refer to Specifications Section 01 35 30 - Health and Safety for additional requirements

1.21 FIRE SAFETY REQUIREMENTS

- .1 Comply with the National Building Code of Canada for fire safety in construction and the National Fire Code of Canada for fire prevention, fire fighting and life safety in building in use.
- .2 Refer to Section 01 35 30 - Health and Safety for further information on Health and Safety

1.22 POWDER ACTUATED DEVICES

- .1 Do not employ powder-actuated guns using explosives, unless expressly permitted by the Departmental Representative.
- .2 If permitted:
 - .1 Comply with requirements of CAN3-Z166.2-M85 (Use and Handling of Powder Actuated Tools).
 - .2 Obtain approval with onsite maintenance staff to determine acceptable time of day usage.
 - .3 Powder-actuated devices may be used before 08h00 and after 17h00 of accepted by onsite maintenance staff.

1.23 REGULATORY REQUIREMENTS

- .1 The following codes and Standards are in place for work under this contract. The latest edition applicable at the time to be utilized.
 - .1 National Building Code of Canada (NBC) 2015
 - .2 National Fire Code of Canada (NFC) 2015.
 - .3 Canadian Electric Code.
 - .4 National Plumbing Code of Canada (NPC) 2015.
 - .5 Canada Labour Code Part II and Federal Occupational Health and Safety Policies

- .6 Construction Standards and/or any other Code or bylaw of local application.
- .2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.
- .3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.
- .4 In any case of conflict or discrepancy, the most stringent requirements shall apply

1.24 FEES

- .1 Obtain and pay for – Building Permit as required by the City of Whitehorse, Certificates, Licenses and other permits required by regulatory municipal, provincial or federal authorities to complete the work.
- .2 Provide inspection authorities with plans and information required for issue of acceptance certificates.
- .3 Furnish inspection certificates in evidence that the work installed conforms to the requirements of the authority having jurisdiction.

1.25 HAZARDOUS MATERIALS

- .1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials: and regarding labeling and the provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources Development Canada, Labour Program.
- .2 The hazardous materials assessment has identified lead in the white paint applied to the gypsum board which will be disturbed by this project.
 - .1 Refer to Section 00 31 00 – Available Project Information for the report.

1.26 WORKMANSHIP

- .1 Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Departmental Representative, if required, if work is such as to make it impractical to produce required results.
- .2 Do not employ any person unfit or unskilled in their required duties. The Departmental Representative reserves the right to require the dismissal from the site, workers deemed incompetent, careless, insubordinate or otherwise objectionable.
- .3 The Work as covered by the Contract Documents documents is intended to comply exactly with the latest rules and regulations of the inspection authorities,

and these rules are to be considered an integral part of the Contract Documents. In case of conflict, any ruling by the Inspection Authority shall be final. All changes and alterations to the Contractor's work required by an authorized inspector or any authority having jurisdiction shall be carried out at the expense of the Contractor.

- .4 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Departmental Representative, whose decision is final.

1.27 EQUIPMENT

- .1 Provide and maintain equipment such as temporary stairs, ladders, ramps, scaffolds, swing stages, runways, chutes and the like, as required for execution of work
- .2 Provide and maintain conveying equipment such as cranes, hoists, derricks and the like, as required for execution of work.
- .3 Assume complete responsibility for construction strength, placing, anchoring and operation of derricks, cranes, hoists and other mechanical contrivances used for work; and ensure that loads carried thereon can be safely supported and be free from accidents to all persons.
- .4 Comply with all governing safety regulations in force at the time of construction.
- .5 Remove immediately such equipment when not required for work.
- .6 Provide and maintain, on site, suitable fire extinguishers in sufficient quantities, as required by the Safety Code.

1.28 HOISTING

- .1 All crane operations are restricted to the following:
 - .1 All craning of materials and equipment must be done outside normal building operating hours, ensure interior areas below are kept unoccupied.

1.29 LOADING

- .1 Take precautions to prevent the overloading of any part of the structure during the progress of the work. Make good, at no expense to Owner, any damage resulting from such overloading.

1.30 SIGNAGE

- .1 No advertising and/or posting of company signs shall be permitted.
- .2 Provide common-use signs as related to traffic control, information, instruction, health and safety, use of equipment, public safety devices, in both official

languages or by the use of commonly understood graphic symbols to the Departmental Representative's approval.

1.31 CONTRACTOR PROJECT SUPERINTENDENT

- .1 The Contractor shall, upon award of contract, designate a Project Superintendent. The Contractor shall provide the name, cellular phone number to the Departmental Representative at the preconstruction meeting.
- .2 The Project Superintendent shall have full responsibility for the project and shall be authorized to accept and act upon any notice or direction provided by the Departmental Representative. Project Superintendent shall be available on site at all times that work is being performed under this contract.
- .3 Supervise and direct all persons engaged in the work, including all tradesmen and suppliers. Become familiar with the requirements of each trade. Coordinate delivery and work operations. Examine the work of all trades during work operations to ensure compliance with the contract requirements. Expedite all work to maintain the contract schedule.
- .4 Cooperate with all other contractors working on site in parallel or related projects.
- .5 Attend coordination and project meetings at the direction of the Departmental Representative.

1.32 CONTRACTOR AND SUB-CONTRACTORS

- .1 The Contractor agrees to employ those sub-contractors proposed by him in writing as listed in the Contractor's tender submission.
- .2 Do not change or substitute approved contractor for sub-contractors without prior authorization from the Consultant.
- .3 Contractor and sub-contractor personnel shall be qualified as per definitions under the Trades Qualification and Apprenticeship Acts and as required by regulatory agencies in the Yukon Territory.

1.33 PRODUCT HANDLING AND STORAGE

- .1 Deliver materials in original and unopened containers or wrappings with Manufacturers' seals and labels intact and legible.
- .2 Deliver materials in sufficient quantity to allow continuity of the work. Do not encumber site with unnecessary materials.
- .3 All unused materials at the end of any working day shall be properly protected from damage.
- .4 All materials, equipment, etc. to be handled and stored as not to interfere with the operation of the building.

- .5 All material and equipment to be new unless specified otherwise.
- .6 Contractors who use controlled products must ensure that their workers are properly trained in the safe use and handling of such products in compliance with the Workplace Hazardous Materials Information System (WHMIS).
- .7 Comply with all requirements with respect to Controlled products labeling and Material Safety Data Sheets (MSDS) according to the requirements of WHMIS and the Hazardous Products Act.

1.34 PRODUCT AVAILABILITY

- .1 Upon award of contract immediately review product delivery requirements and advise the design authority of any foreseeable delays.
- .2 In the event of failure to notify the Departmental Representative at commencement of the work, the Departmental Representative reserves the right to require the supply of substitute products of equivalent quality at no increase in contract price to ensure adherence to project schedule.

1.35 MATERIALS STANDARDS

- .1 Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the National Building Code of Canada and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirements shall apply.
- .2 Products (materials, equipment and articles) incorporated in work shall be new, not damaged or defective and of best quality compatible with specifications for purpose intended. If requested by the design authorities, furnish evidence as type, source, and quality of product.
- .3 Defective products will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is a precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should any dispute arise as to the quality of fitness of products, the decision shall rest with the Departmental Representative based upon requirements of Contract Documents. The Departmental Representative's decision shall be final.
- .5 Ensure that materials, equipment, services and labour are brought to site in sufficient quantity and in accordance with requirements of the work schedule.
- .6 Use materials/products containing highest percentage of recycled and recovered materials practicable – consistent with maintaining cost effective satisfactory levels of completion. Adhere to waste reduction requirements for reuse or recycling of waste materials, thus diverting materials from landfill

1.36 PROTECTION

- .1 Protect finished work against damage until take-over.
- .2 Protect the work and all surrounding equipment, landscape, structures, floors, ceilings, walls, etc., from damage.
- .3 Make good, at no cost to the Owner, any damage caused.
- .4 Protect any services, which are uncovered during work.
- .5 Protect all areas adjacent to the construction areas from dust and debris produced during construction. Use hoarding, solid walls, drop cloths, sealed dust screens and tarps and clean up and vacuum up all debris daily.

1.37 MATERIALS OTHER THAN SPECIFIED

- .1 Secure in writing, permission from the Departmental Representative to use any materials other than those specified.
- .2 The listed suppliers/manufacturers are acceptable for their ability to meet the general design intent, quality and performance characteristics of the specified product. The listed equipment/materials does not endorse the acceptability of all products available from the listed manufacturers/suppliers.
- .3 It remains the responsibility of the Contractor to ensure the products supplied are equal to the specified products in every aspect, operate as intended, and meet the performance specifications and physical dimensions of the specified product.
- .4 The Contractor shall be fully responsible for any additional materials, to accommodate the use of equipment from the acceptable manufacturer and suppliers list.

1.38 PROPOSED SUBSTITUTIONS

- .1 Where equivalent products have been submitted without specifics, it is the Contractor's responsibility to provide detailed specifications highlighting differences to the specified unit prior to requesting for acceptance as equal. Requests without inclusion of sufficient details will automatically be rejected. Provide differences and clear quantifiable characteristics why, how and where the unit meets performance and other requirements. Requests for substitution must be made to the Departmental Representative.
- .2 Products specified serves to set minimum standard. Substituted equipment shall meet performance requirements and physical limitations, including fitting within space constraints.

1.39 WARRANTY

- .1 Provide written one (1) year guarantee for all materials and labour provided as part of this Contract. Effective start date shall be date of final completion.

- .2 Provide extended warranties as requested in specification.
- .3 The Contractor, at own expense, shall correct any defects in the work due to faulty products and/or workmanship appearing within the extended guarantee/warranty periods set out in the individual sections from date of final completion.

1.40 CLEANING

- .1 Remove waste materials and debris from the site at the end of each day. Leave the work area unencumbered upon completion of each work shift. Store materials and equipment.
- .2 Ensure site is clean, orderly and neat at all times during the work shift. Provide additional cleaning as requested by the Departmental Representative and Owner.
- .3 At the end of the project, remove dirt, dust and other disfigurements from all surfaces affected by the project including, but not limited to ceilings, walls, floors, fixtures and lights. Clean by dusting, damp wiping, washing, waxing and polishing to the satisfaction of the Departmental Representative and Owner.
- .4 Upon completion, remove scaffolding, temporary protections and surplus materials. Make good any defects noted at this stage.
- .5 Clean areas affected under contract, to a condition at least equal to that previously existing and to satisfaction of the Departmental Representative and Owner.
- .6 Use only cleaning materials recommended by manufacturer of surface to be cleaned.

1.41 WASTE MANAGEMENT

- .1 Comply with the Environmental Protection Act for waste management programs on construction and demolition projects.

1.42 O&M MANUALS

- .1 Provide two (2) sets of operations and maintenance data detailed in Section 01 78 00 - Closeout Submittals. Data to include detailed technical information, documents and records describing operation and maintenance of individual components.
- .2 Provide digital O&M set in portable document format (PDF) as detailed in Section 01 78 00 – Closeout Submittals.

1.43 RECORD DRAWINGS

- .1 As work progresses, maintain accurate records to show deviations from the contract drawings. Just prior to completion of work, supply to the Departmental Representative one set of white prints with all deviations neatly inked in with red pen.

1.44 SUBMISSION OF TENDER

- .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract Documents and is fully conversant with all conditions.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of the Consultant and Owner.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting five working days in advance of meeting date to Consultant and Owner.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three working days after meetings and transmit to meeting participants, affected parties not in attendance, Consultant, and Owner.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 working days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Owner, Consultant, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 working days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Introduction of Owner's and Contractor's representatives.
 - .2 Code of conduct for the place of the Work.
 - .3 Appointment of official representative of participants in the Work.
 - .4 Status of permits, fees and requirements of the Authority Having Jurisdiction.
 - .5 Schedule of Work.
 - .6 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00- Submittal Procedures.
 - .7 Schedule for progress meetings.
 - .8 Requirements for notification for reviews. Allow a minimum of 48 hours' notice to Consultant for review of the Work.

- .9 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .10 Owner provided products.
- .11 Requirements for firestopping.
- .12 Record drawings in accordance with Section 01 33 00- Submittal Procedures.
- .13 Commissioning requirements.
- .14 Maintenance manuals in accordance with Section 01 78 00- Closeout Submittals.
- .15 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00- Closeout Submittals.
- .16 Monthly progress claims, administrative procedures, photographs, hold backs.
- .17 Appointment of inspection and testing agencies or firms.
- .18 Insurances, transcript of policies.
- .19 Contractor's safety procedures and clearance letters.

1.3 PROGRESS MEETINGS

- .1 During course of Work schedule progress meetings as directed by the Consultant.
- .2 Contractor, Contractor's site superintendent(s), major Subcontractors involved in Work, Consultant and Owner are to be in attendance.
- .3 Frequency: Every two weeks, or as otherwise directed by the Owner.
- .4 Location: Contractor's site office, or other location agreed to between the Owner and Contractor.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review of Contract modifications and interpretations for affect on construction schedule and on completion date.
 - .12 Review of commissioning pre-facility start-up progress and form preparation.

.13 Other business.

1.4 TANK REMOVAL AND REMEDIATION MEETINGS

- .1 Prior to UST removal and within 7 working days prior to start of work request a meeting of parties in contract to discuss schedule, testing and permitting
- .2 Owner, Consultant, Contractor, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 working days before meeting.
- .4 Agenda to include:
 - .1 Timing of work and testing requirements (performed by consultant)
 - .2 Layout down area
 - .3 Permitting and approvals
 - .4 Soils remediation and disposal plan
 - .5 Fire safety plan
 - .6 Excavation and safety plan.
 - .7 Provide work plan in accordance with 02 65 00.

1.5 COMMISSIONING PROGRESS MEETINGS

- .1 During commissioning and facility start-up, schedule commissioning progress meetings every 2 weeks.
- .2 Contractor, Contractor's site superintendent(s), major Subcontractors involved in Work, Commissioning Agent, Consultant and Owner are to be in attendance.
- .3 Location: Contractor's site office, or other location agreed to between the Owner and Contractor.
- .4 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Commissioning progress since previous meeting.
 - .3 Identification of problems impeding progress towards achievement of Commissioning (Facility Start Up) milestones.
 - .4 Review of outstanding Contract Deficiencies.
 - .5 Review of Contract modifications and interpretations.
 - .6 Other business.

1.6 PRE-TAKEOVER MEETING

- .1 A minimum of 10 working days prior to application for Substantial Performance, schedule a pre-takeover meeting.
- .2 Contractor, Contractor's site superintendent(s), major Subcontractors involved in Work, Consultant and Owner are to be in attendance.
- .3 Agenda to include the following:

- .1 Review, approval of minutes of previous meeting.
- .2 Review of procedures for Substantial Performance, Total Performance, and handover of the Work.
- .3 Field observations, problems, conflicts.
- .4 Review of Contract modifications and interpretations for affect on construction schedule and on completion date.
- .5 Problems which impede Substantial Performance of the Work.
- .6 Review of procedures for deficiency reviews and corrective measures.
- .7 Review of arrangement for building services.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal requirements for close-out submittals, all demonstrations and documentation required for Substantial Performance.
- .10 Review of keying and hardware requirements.
- .11 Review of status of as-built documents.
- .12 Status of commissioning and training.
- .13 Review of Contractor's deficiency list and status.
- .14 Cleaning for occupancy.
- .15 Demobilization.
- .16 Other business.

1.7 POST CONSTRUCTION MEETING

- .1 Prior to application for Total Performance, schedule a post-construction meeting.
- .2 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Confirmation of completion of the Contract, and handover of reviewed documentation from the Consultant to the Owner.
 - .3 Confirmation of completion of Contract modifications.
 - .4 Problems which impede Total Performance of the Work.
 - .5 Identification of unresolved issues or potential warranty problems.
 - .6 Confirmation of completion of deficiencies.
 - .7 Corrective measures required.
 - .8 Confirm submittal requirements for Closeout submittals and Total Performance are in order.
 - .9 Review of procedures for communication during post-construction period.
 - .10 Handover of record documents by the Consultant to the Owner.
 - .11 Handover of Contract completion insurance policy transcripts to the Owner.
 - .12 Submission of final application for payment.
 - .13 Review and finalize outstanding claims, pricing, and allowance amounts.
 - .14 Status of commissioning and training.
 - .15 Demobilization and restoration.

.16 Other business.

1.8 WARRANTY MEETINGS

- .1 Owner reserves the right to require meetings during the warranty period to review Contract deficiencies, to determine action required for their correction, and to monitor progress of corrections related to previously identified Contract deficiencies.
- .2 Contractor, affected Subcontractors, Consultant and Owner are to be in attendance.

1.9 SPECIAL MEETINGS

- .1 Owner and/or Consultant reserve the right to require special meeting which may be held on short notice and at which the attendance by the Contractor and representative of the affected Subcontractors and Suppliers is mandatory.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

- .1 Shop drawings and product data.
- .2 Samples.
- .3 Certificates and transcripts.

1.2 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.3 ENGINEERED SUBMITTALS

- .1 Submittals for items required to be sealed by professional engineer (engineered) shall be duly prepared, sealed, and signed under the direct control and supervision of a qualified professional engineer licensed in the jurisdiction in

- which the Place of the Work is located, having in force, professional liability insurance with minimum coverage limit of \$1,000,000 per claim and annual aggregate.
- .2 Include with engineered submittal, proof of insurance identifying insurer, policy number, policy term, and limit of liability, on duly signed letterhead and / or certificates of insurance.
 - .3 Design includes life safety, sizing of supports, anchors, framing, connections, spans, and as additionally required to meet or exceed requirements of applicable codes, standards, regulations, authorities having jurisdiction, and design requirements of the Contract Documents.
 - .4 Engineered submittals shall include design calculations, complete with references to codes and standards used in such calculations, supporting the proposed design represented by the submittal.
 - .5 Professional engineer responsible for the preparation of engineered submittals shall undertake periodic field review, including review of associated mock-ups where applicable, at locations wherever the work as described by the engineered submittal is in progress, during fabrication and installation of such work, and shall submit a field review report after each visit. Field review reports shall be submitted to the Consultant, to authorities having jurisdiction as required, and in accordance with the building code.
 - .6 Field reviews shall be at intervals as necessary and appropriate to the progress of the work described by the submittal to allow the engineer to be familiar with the progress and quality of such work and to determine if the work is proceeding in general conformity with the Contract Documents, including reviewed shop drawings and design calculations.
 - .7 For parts of the Work covered by the engineered submittal, the professional engineer responsible for the preparation of the engineered submittal and for undertaking the periodic field reviews described above, shall prepare and submit to the Consultant Letters of Assurance for those parts of the Work, certifying that they have been Provided in accordance with the requirements both of the Contract Documents and of the authorities having jurisdiction over the Place of the Work.
 - .8 Costs for such field reviews and field review reports and letters of assurance are included in the Contract Price.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information

necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .3 Allow 5 business days for Departmental Representative's review of each submission.
- .4 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of any revisions other than those requested.
- .6 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .7 Submissions 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, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.

- .9 Single line and schematic diagrams.
- .10 Relationship to adjacent work.
- .8 After Departmental Representative's review, distribute copies.
- .9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .10 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .11 Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.
- .13 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.5 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.6 PROGRESS PHOTOGRAPHS

- .1 Submit weekly progress photographs.

1.7 CERTIFICATES AND TRANSCRIPTS

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Make Submittals in accordance with Section 01 11 00 - General Instructions.
- .2 Submit a site-specific Health and Safety Plan, within 7 days after Notice to Proceed and prior to commencement of Work. The Health and Safety Plan must include:
 - .1 Site-specific safety hazard assessment.
 - .2 Safety and health risk or hazard analysis for site risks and operation.
- .3 Submit Construction Safety Checklists after completion.
- .4 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit to Departmental Representative with Material Safety Data Sheets (MSDS).
- .7 Personal training requirements including as follows:
 - .1 Names of personnel and alternates responsible for site safety and health, hazards present on site, and use of personal protective equipment.
- .8 The Departmental Representative will review the Contractor's site-specific Health and Safety Plan and provide comments to the Contractor within 7 days after receipt of the plan. Revise the plan as appropriate and resubmit plan to the Departmental Representative within 3 days after receipt of comments from the Departmental Representative.
- .9 Medical Surveillance: Within 7 days after date of the Notice to Proceed and prior to mobilization to the site, submit certification of medical surveillance for site personnel, and submit additional certifications as personnel are sent to the site.
- .10 On-site Contingency and Emergency Response Plan: Address the standard operating procedures to be implemented during emergency situations.

1.2 FILING OF NOTICE

- .1 File Notice of Project with Territorial authorities prior to beginning of Work.

1.3 SAFETY ASSESSMENT

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

1.4 MEETINGS

- .1 Pre-construction meetings: The Contractor shall attend a Pre-Construction Meeting.

1.5 REGULATORY REQUIREMENTS

- .1 The Contractor shall comply with the specified standards and regulations to ensure safe operations. The latest editions are applicable.
 - .1 Canada Labour Code Part II
 - .2 Canada Occupational Safety and Health Regulations
 - .3 National Building Code Part 8 – Safety Measures at Construction & Demolition Sites
 - .4 National Fire Code Part 4 – Flammable and Combustible Liquids
 - .5 National Fire Code Part 5 – Hazardous Process and Operations
 - .6 Yukon Health and Safety Act and Regulations including;
 - .1 Construction Projects
 - .2 Occupational Health and Safety Act
 - .3 Workplace Hazardous Materials Information System (WHMIS)
 - .4 Trades Qualification and Apprenticeship Act
 - .5 Electrical Safety Code

1.6 CONTRACTOR RESPONSIBILITY

- .1 The Contractor shall be responsible for the Health and Safety of persons on site, safety of property on site and for the protection of persons adjacent to the site and environment to the extent that they may be affected by the conduct of Work.
- .2 The Contractor shall comply with and enforce compliance by their employees with the safety requirements of the Contract Documents, applicable federal, provincial, local statutes, regulations, ordinances, and site-specific Health and Safety Plan. (i.e. Occupational Health and Safety Acts and Regulations for Construction Projects, Canada Labour Code Part II)

1.7 CONTRACTOR ACCIDENT AND INCIDENT REPORT

- .1 The Contractor shall advise the Departmental Representative of any accident, injury, near-miss incident, fire, explosion or chemical spill occurring at the Work site and any visit to the site by a governmental enforcement official.

1.8 UNFORSEEN HAZARDS

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

1.9 WORK STOPPAGE

- .1 The Departmental Representative and/or designated Health and Safety personnel may stop work for health and safety considerations.
- .2 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

1.10 CORRECTION OF NON-COMPLIANCE

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

1.11 DISCIPLINARY ACTIONS

- .1 The Contractor's disregard and/or lack of compliance to health and safety measures, procedures and policies shall lead to disciplinary action by the Departmental Representative.

1.12 HAZARDOUS MATERIALS

- .1 See Section 00 31 26 for results of hazardous material assessment. Where work will modify or alter areas identified or suspected to contain hazardous materials, follow work procedures by Workers Compensation Board.
- .2 Ensure works does not disperse or otherwise distribute hazardous materials to other areas of the building.
- .3 Comply with safety regulations and recommendations outlined in the assessment report. Where direction is unclear, engage the services of a specialist to recommend a suitable safety plan.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 02 81 01 - Hazardous Materials
- .2 Section 02 82 00.001 - Asbestos Abatement Minimum Precautions.
- .3 Section 02 65 00 - Aboveground Storage Tank Removal

1.2 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide and use marked separate bins for recycling. Refer to Section 01 74 19- Waste Management and Disposal.
- .5 Dispose of waste materials and debris at designated dumping areas off site.
- .6 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Owner or other Contractors.

- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .8 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .9 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .10 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .11 Remove snow and ice from access to building.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 As-built, samples, and specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.

1.2 RELATED REQUIREMENTS

- .1 Division 20 – Common Mechanical Works: Mechanical and Electrical closeout submittal requirements.

1.3 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, two final copies of operating and maintenance manuals in English. The Departmental Representative's review to determine Substantial Performance of the Work will not take place until the Departmental Representative has received acceptable copies of the O&M manuals.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.4 **FORMAT**

- .1 Organize data in the form of an instructional manual.
- .2 Binders: bound using expanding spine catalogue binders complete with plated piano hinges, hard covered, expandable pots, 210 x 275 mm with spine and face embossed with Project title. Provide sufficient volumes to allow each binder to hold system data while in full closed position, and to be no more than 75% full. Provide artwork and colour to Owner for approval prior to binder construction
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data. Data in tables are to be entered in MS-Excel format. Include PDF's and spreadsheet on CD/DVD.
- .8 Language: All text to be in English.
- .9 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .10 Electronic Copy: Provide electronic copy of all closeout submittals on a USB storage device as follows:
 - .1 File type to be a composite electronically indexed portable document format file (PDF).
 - .2 Name each indexed document file in the composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - .3 Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - .4 File Names and Bookmarks:
 - .1 Enable bookmarking of individual documents based on file names.
 - .2 Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents.
 - .3 Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree.

- .4 Configure electronic manual to display bookmark panel on opening file.
- .5 Enable inserted reviewer comments on draft submittals.

1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 date of submission; names,
 - .2 addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties;
 - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.6 AS-BUILTS AND SAMPLES

- .1 In addition to requirements in General Instructions, maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.8 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

- .3 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.9 SPARE PARTS

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

1.10 MAINTENANCE MATERIALS

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

1.11 SPECIAL TOOLS

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

1.12 STORAGE, HANDLING AND PROTECTION

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

- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.13 WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General**1.1 SECTION INCLUDES:**

- .1 Materials installed in joints to resist the spread of fire and smoke.
 - .1 Joints in or between fire resistance-rated construction.
 - .2 Mechanical, electrical and communications penetrations of fire-resistant assemblies.

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 – Gypsum Board Assemblies
- .2 Section 09 22 16 – Non-Structural Metal Framing.
- .3 Mechanical.
- .4 Electrical.

1.3 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Fire stop Systems.
- .3 ATM E-119, 'Fire Tests for Building Construction and Materials'.
- .4 UL 2079, 'Tests for Resistance of Building Joint Systems'.
- .5 National Building Code of Canada (NBCC) 2020.
- .6 National Fire Code (NFC) 2020.
- .7 NFPA 101, 'Life Safety Code'.
- .8 Canadian Electrical Code.

1.4 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.5 DESCRIPTION OF WORK

- .1 Provide all labour, materials, services and equipment necessary for the supply and installation of firestopping and smoke seals where indicated on the drawings, as specified and scheduled.
- .2 Provide tested firestop material or material systems used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, water and hot gases through penetrations in fire rated wall and floor assemblies, including:
 - .1 Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated walls and partitions, horizontal floor/ceiling assemblies and vertical service shaft walls and partitions.
 - .2 Openings between structurally separate sections of wall or floors.
 - .3 Gaps between the top of walls and ceilings or roof assemblies.
 - .4 Expansion joints in walls and floors.
 - .5 Openings and penetrations in fire-rated partitions or walls containing fire doors.
 - .6 Openings around structural members that penetrate floors or walls.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit a complete firestopping and smoke seal shop drawing using Architectural Floor Plans; show all locations of firestop seals, including Mechanical and Electrical seals.
 - .1 Indicate applicable listed ULC system and design number as applicable.
 - .2 Show all fire rated walls and floor penetrations. Show all penetrations and develop an indexing system.
 - .3 Submit shop drawings allowing for review time prior to forming of concrete openings and placement of sleeves by Mechanical and Electrical.

- .4 Provide copies of reviewed shop drawings to Mechanical and Electrical subtrades.
- .4 Engineered Shop Drawings, for Engineering Judgements:
 - .1 Where Project conditions require modification to an accredited third-party testing agency's listed system design to address a particular firestopping condition that is not covered by a listed system, submit engineered shop drawings detailing the modifications to the listed system design as an engineering judgment or equivalent fire-resistance-rated assembly, for each Project location and condition.
 - .2 Submit the manufacturer's engineering judgment identification number and shop drawing details prepared by a professional engineer. The engineering judgment submittal shall include both Project name, Project location, and Subcontractor's name who will install firestop system as described in engineering judgement shop drawings.
 - .3 Provide complete details of specific application of listed system and its modifications upon which the engineered judgement is based upon.
 - .4 For perimeter fire barrier systems:
 - .1 Submit engineered shop drawings for engineering judgements covering perimeter fire barrier systems. Identify each cladding assembly type in contact with each perimeter fire barrier system.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.7 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: Work of this section, **executed by installers with minimum 5 years experience** in application of Products, systems and assemblies specified and with approval, training and certification of Product manufacturers.
 - .2 Firestopping is not to be installed by mechanical or electrical trades unless the installer meets the requirements above.
 - .3 If installation of Firestopping is to be completed by the mechanical or electrical trades, the Contractor must provide one coordinated Submittal.

- .2 Firestop system to meet requirements of CAN4-S115-M, ULC S-115-M or UL 2079 tested assemblies providing a fire rating equivalent to the required supporting construction assembly.
- .3 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994, as may be amended from time to time).

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

1.9 PROJECT CONDITIONS

- .1 Do not use materials that contain flammable solvents.
- .2 Schedule installation of firestopping after completion of penetrating item installation but before covering or concealing openings.
- .3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- .4 Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation.
- .5 Provide masking and drop cloths during installation to prevent firestopping materials from contaminating any adjacent surfaces.

Part 2 Products

2.1 FIRESTOPPING

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-

S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.

- .2 Firestopping components compatible with each other, substrates forming openings and items penetrating the firestopping under conditions of service and application.
- .3 Where ‘cast-in-place’ firestopping materials are used, provide firestopping devices prior to concrete placement.
- .4 Fire stop system rating:
 - .1 For penetrations through a fire wall or horizontal fire separation provide a firestop system with a ‘FT’ rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
 - .2 For combustible pipes, tubing, ducts, chimneys, optical fibre cables, electrical wires and cables, totally enclosed non-combustible raceways, electrical outlet boxes and similar building services that penetrate through a fire separation provide a firestop system with a ‘F’ Rating as determined by ULC or cUL as indicated below:

Separation Fire Resistance Rating	Firestopping Required ULC or cUL ‘F’ Rating
30 minutes	20 minutes
45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hour
3 hours	2 hours

For combustible pipe penetrations through a fire separation provide a firestop system with a ‘F’ Rating as determined by ULC or cUL (when tested with a pressure differential of 50 Pa between exposed and unexposed sides) which is equal to the fire resistance rating of the construction being penetrated.

- .3 For joints provide a firestop system with an Assembly Rating as determined by CAN4-S115-M, ULC-S115-M or UL 2079 which is equal to the fire resistance rating of the construction being penetrated.
- .5 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .6 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .7 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .8 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .9 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

2.2 MANUFACTURERS

- .1 Subject to compliance with through penetration firestop systems and joint systems listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following acceptable manufacturers:
 - .1 3M Fire Protection Products.
 - .2 Hilti (Canada) Limited.
 - .3 Tremco Sealants & Coatings.
 - .4 Other manufacturers listed in the above noted reference Standards.
- .2 Provide firestopping and smoke seal materials from a single manufacturer for each different product type required.

2.3 ACCESSORIES

- .1 Fibre Insulation: Alumina-silica refractory fibre insulation in blanket or bulk form with service temperature limit of 1315 degrees C, melting point of more than 1760 degrees C, specific gravity 2.56, thickness to suit application.
- .2 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .3 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .4 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .5 Sealants for vertical joints: non-sagging.

Part 3 Execution**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 COORDINATION

- .1 Coordinate location and proper selection of cast-in-place firestop devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- .2 Provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interference.

3.4 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Consult with related trades before installation of ULC or cUL firestop systems that might hamper the performance of fire dampers in duct work.
- .4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .5 Tool or trowel exposed surfaces to neat finish.
- .6 Remove excess compound promptly as work progresses and upon completion.
- .7 Protect materials from damage on surfaces subjected to traffic.

3.5 FIELD QUALITY CONTROL

- .1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.
- .2 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- .3 Perform patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- .4 Install a warning card visible adjacent to all large and medium openings that may be repenetrated. Provide the following information on the card:
 - .1 Warning that the opening has been fire stop protected.
 - .2 Indicate the fire stop system used, ULC or cUL.
 - .3 F or FT rating.
 - .4 Fire stop products used.
 - .5 Person to contact and phone number in case of modification or new penetration of fire stop system.

3.6 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by the Consultant.
- .2 Install floor fire stopping before interior partition erections.
- .3 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.7 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.8 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated gypsum board partitions and walls.
 - .2 Top of fire-resistance rated gypsum board partitions.
 - .3 Intersection of fire-resistance rated gypsum board partitions.
 - .4 Control and sway joints in fire-resistance rated gypsum board partitions and walls.
 - .5 Penetrations through fire-resistance rated floors, ceilings and roofs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Around mechanical and electrical assemblies penetrating fire separations.
 - .8 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 08 71 00 – Door Hardware.
- .2 Section 09 21 16.08 – Gypsum Board Assemblies for Minor Works
- .3 Section 09 91 00.08 – Painting for Minor Works

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .3 CSA Group (CSA)
 - .1 CSA-G40.20-04 /G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S104-M80, Standard Method for Fire Tests of Door Assemblies.
 - .2 CAN/ULC-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 for ratings specified or indicated.

- .2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC-S104, and listed by nationally recognized agency having factory inspection services.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide shop drawings: in accordance with Section 01 33 00- Submittal Procedures.
 - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, louvred, glazed, arrangement of hardware, fire rating, and finishes.
 - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire rating, and finishes.
 - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's recommendations.

Part 2 Products

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.
- .3 Composites: balance of core materials used in conjunction with lead: in accordance with manufacturers' proprietary design.

2.2 DOOR CORE MATERIALS

- .1 Honeycomb construction:
 - .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m
- .2 Stiffened: face sheets laminated, insulated core.
 - .1 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m

2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

2.4 PRIMER

- .1 Touch-up primer: to CAN/CGSB-1.181.

2.5 PAINT

- .1 Field paint steel frames in accordance with Section 09 91 00 - Painting. Protect seals from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Metallic paste filler: to manufacturer's standard.
- .3 Fire labels: metal riveted.

2.7 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Interior frames: 1.2 mm slip-on type construction.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Protect mortised cut-outs with steel guard boxes.
- .6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .7 Manufacturer's nameplates on frames are not permitted.
- .8 Conceal fastenings except where exposed fastenings are indicated.
- .9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: SLIP-ON TYPE

- .1 Ship slip-on type frames unassembled.

- .2 Provide frames with mechanical joints which inter-lock securely and provide functionally satisfactory performance when installed in accordance with CSDMA Recommended Installation Guide for Steel Doors and Frames and manufacturers' instructions.
- .3 Provide slip-on frames with manufacturers' proprietary design of wall anchorage comprising single, adjustable tension type per jamb and provision for secure attachment of each jamb base to stud runners.

2.10 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior doors: thermally broken hollow steel construction. Interior doors: honeycomb construction.
- .3 Fabricate doors with longitudinal edges locked seamed, adhesive assisted. Seams: visible.
- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware, and electronic hardware.
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .8 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC-S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .9 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

- .1 Form face sheets for interior doors from 1.2 mm sheet steel with honeycomb core laminated under pressure to face sheets.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.

3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Doors Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latch side and head: 1.5 mm.
 - .3 Finished floor, and thresholds, top of carpet, or non-combustible sill: 13 mm.
- .3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.6 PAINTING

- .1 Site paint all metal doors and frames in accordance with Section 09 91 00 – Painting.

END OF SECTION

Part 1 General**1.1 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.2-2003, Bored and Preambled Locks and Latches.
 - .3 ANSI/BHMA A156.4-2000, Door Controls - Closers.
 - .4 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.
 - .5 ANSI/BHMA A156.6-2005, Architectural Door Trim.
 - .6 ANSI/BHMA A156.8-2005, Door Controls - Overhead Stops and Holders.
 - .7 ANSI/BHMA A156.15-2006, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
 - .8 ANSI/BHMA A156.16-2002, Auxiliary Hardware.
 - .9 ANSI/BHMA A156.18-2006, Materials and Finishes.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

- .3 Submit manufacturer's parts lists and instructions for closers, locksets, exit devices and electronics upon completion of work.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
 - .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
 - .3 Make a detailed review of the Schedule of Finish Hardware and make whatever allowance in tender price appropriate to accommodate changes which may be necessary.
 - .4 Supplier must be an established contract builders' hardware firm. Persons responsible for the complete finish hardware contract for this project, including: scheduling, detailing, ordering and coordinating hardware, shall be experienced Architectural Hardware Consultants (AHC) and members in good standing with the Door and Hardware Institute (DHI).
 - .5 All finish hardware to conform to CAN/CGSB 69-GP Series-M90/ANSI/BHMA-A156 Series.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

1.6 PRE-APPROVED ALTERNATES

- .1 Bid only those products specified; or for the purpose of tendering, products listed as equivalents or other pre-approved alternative.
- .2 Substituted non-approved items will be replaced with specified items and all related costs will be borne by the supplier. This project will be inspected upon completion to ensure compliance.
- .3 Submit requests for approval of alternative material or product in writing to the Consultant no later than ten (10) days prior to bid closing. Submissions shall be made in duplicate. Provide samples of the products and finishes proposed if and when requested by the Consultant.

1.7 WARRANTY

- .1 All finish hardware shall be guaranteed by the hardware manufacturer, with written certification, for a period of one (1) year from the date of "substantial completion" against any defects in the design, materials and workmanship, except closers and exit devices. Any defects will be made good by the manufacturer at no additional cost to the owner.

Part 2 Products**2.1 DESIGN PRINCIPALS AND STANDARDS**

- .1 Hardware for fire doors shall meet Underwriters requirements. Submit written certification of conformance to ULC requirements for each type of hardware prior to delivery.
- .2 All doors shall be accessible to residents in wheelchairs, including public and common areas.
- .3 All doors to be barrier free and shall have lever handles consistent with the specified grade of locks for that application.

2.2 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.
- .2 Hardware shall be best grade, entirely free from imperfections in manufacture and finish and shall be supplied in accordance with the hardware list specified herein.
- .3 The following list of manufacturers and products are considered approved for this project and no variations from the listed or pre-approved items will be permitted:
 - .1 Hinges: McKinney or Pemko.
 - .1 Note: All hinges to be 3 knuckle with 2 concealed bearings, material and finish as specified.
 - .2 Locksets, Latchsets and Privacy sets: Sargent 7-line and 10-Line, Adams Rite 2190
 - .3 Magnetic Locks & Power Supplies: Securitron.
 - .4 Closers: Sargent 351 Series; Sargent 1431 Series.
 - .1 All closers must be ULC listed and certified under ANSI standards A156.4 Grade 1. Use one manufacturer for all closer units throughout the work.
 - .5 Electric Strikes: Hes.
 - .6 Door Stops & Pulls: Gallery, Richelieu.
 - .7 Kick Plates: Gallery.
 - .8 Thresholds, Seals and Door Bottoms: KN Crowder or Pemko.
 - .1 ULC fire/sound/smoke labels where required.
 - .2 Thresholds for all doors shall allow for passage of a wheelchair.
 - .9 Overhead Stops: Rixson.
 - .10 Harness: Tillicum Agencies.
- .4 Installed items to be equal in all respects to approved samples.
- .5 Supply all templates as required. Frame manufacturer will allow for maximum swing of doors when templating for closers. On pairs of doors RHR leaf is to be active unless otherwise noted.

- .6 Package hardware with all necessary screws and fittings, clearly labelled with door number as per Door Schedule, as to intended location. Include all necessary installation instructions.
- .7 Any doors not listed shall have hardware as listed for similar locations.

2.3 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.4 KEYING

- .1 Doors, padlocks and cabinet locks to be master keyed to existing keying system. Prepare detailed keying schedule in conjunction with Consultant.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Stamp keying code numbers on keys and cylinders.

2.5 FINISH

- .1 All hardware finishes shall match throughout the project, generally satin chrome, stainless steel or as noted in the finish hardware schedule.

Part 3 Execution

3.1 GENERAL

- .1 Confer with the various sections of work and refer to the detail drawings before ordering hardware to be sure that it will conform to and fit actual conditions on the job.
- .2 Before furnishing hardware, check drawings for hardware requirements, verify door swings, check shop drawings, frame and door lists, and advise in writing if revisions are required. Ensure early delivery of hardware required for this project.
- .3 Supply complete information and templates required by the metal door and frame manufacturers to provide reinforcing for the application of hardware.
- .4 Submit the names of hardware manufacturers used in the preparation of the Tender. If the manufacturer's names are not stated, it shall be understood to mean that the hardware will be purchased from the manufacturers specified.

3.2 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply all door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- .5 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .6 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

3.3 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by door hardware installation.

3.5 SCHEDULE

.1	Hardware group No. 1. (Mechanical Room Door)				
	3	Ea.	Butt Hinges	TA714 4½ x 4	26D
	1	Ea.	Storeroom Locket	10xLL04	26D
	1	Ea.	Closer	1431-O	26D
	1	Ea.	Wall Stop	GSH 240	26D
	1	Ea.	Door Seal	W-66	BL
	1	Ea.	Threshold	CT-11	AL
	2	Ea.	Kickplates	80A, 200 x 880	32D

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 08 11 00 – Metal Frames
- .2 Section 09 22 16 – Non-Structural Metal Framing.
- .3 Section 09 91 00.08 – Painting for Minor Works.

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C475-02(2015), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C645-09a, Standard Specification for Nonstructural Steel Framing Members.
 - .3 ASTM C754-09a, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .4 ASTM C840-16, Standard Specification for Application and Finishing of Gypsum Board.
 - .5 ASTM C954-15, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .6 ASTM C1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .7 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .2 Association of the Wall and Ceilings Industries International (AWCI)
 - .1 AWCI Levels of Gypsum Board Finish-GA-214-2015.
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum, framing, insulation and sealants and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Handling Requirements in accordance with ASTM C 840–16:
 - .1 Store gypsum board assemblies materials level flat in indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
 - .3 Protect gypsum board from direct exposure to rain, snow, sunlight, or other excessive weather conditions.
 - .4 Protect ready mix joint compounds from freezing, exposure to extreme heat and direct sunlight.
 - .5 Protect from weather, elements and damage from construction operations.
 - .6 Handle gypsum boards to prevent damage to edges, ends or surfaces.
 - .7 Protect prefinished aluminum surfaces with [strippable coating] [wrapping] . Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
 - .8 Replace defective or damaged materials with new.

1.5 AMBIENT CONDITIONS

- .1 Maintain temperature 10 °C minimum, 21 °C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, clean surfaces.
- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

Part 2 Products**2.1 MATERIALS**

- .1 Standard board: to ASTM C1396/C1396M–14 regular, Type X and Type C, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut.
- .2 Metal furring runners, hangers, tie wires, inserts, and anchors: to suit specified assembly and as recommended by manufacturer.
- .3 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .4 Resilient drywall furring/clips: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- .5 Steel drill screws: to ASTM C1002-14.

- .6 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc-coated, 0.5 mm base thickness, perforated flanges, one-piece length per location.
- .7 Sealants: in accordance with Section 07 92 00- Joint Sealants.
- .8 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.
- .9 Joint compound: to ASTM C475, asbestos-free.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assembly installation in accordance with manufacturer's written instructions.

3.2 ERECTION OF GYPSUM BOARD AND ACCESSORIES

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.
- .3 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
- .4 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .5 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.
- .6 Install acoustical insulation and sealant in sound rated partitions to correspond with tested assembly.
- .7 Install gypsum boards in direction that will minimize number of end-butt joints. Stagger end joints 250 mm minimum.

3.3 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .2 Apply single- and double-layer gypsum board to metal and wood furring or framing using screw fasteners for all layers. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C840-16.
 - .2 Apply gypsum board on walls vertically or horizontally, providing sheet lengths that will minimize number of board edges or end joints.

- .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
 - .3 Apply base layers at right angles to supports unless otherwise indicated.
 - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

3.4 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .6 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 0: no tapping, finishing or accessories required.
 - .2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .1 Location: unexposed ceiling spaces and plenums to maintain fire rating.
 - .3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .4 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

- .5 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .1 Location: Ceilings and walls exposed to view.
- .6 Level 5: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
- .7 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .8 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board, invisible after surface finish is completed.
- .9 Completed installation smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.5 CLEANING

- .1 Progress and Final Cleaning: clean in accordance with Section 01 11 55 – General Instructions.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by partition installation.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 09 21 16.08 – Gypsum Board Assemblies for Minor Works.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM C645-14e1, Standard Specification for Nonstructural Steel Framing Members.
 - .2 ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
 - .3 ASTM C754-15, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .2 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .1 MPI #26, Primer, Galvanized Metal, Cementitious.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

Part 2 Products**2.1 MATERIALS**

- .1 Interior Steel Studs: C-shape hot dipped galvanized steel studs with Z180 galvanized coating to ASTM A653/A653M for 0.84 mm studs. Roll formed from ASTM A446, Grade A steel base metal thickness before galvanizing.
 - .1 Flange not less than 32 mm (1-1/4") wide, edge to be bent back 90 degrees and doubled over to form a minimum 4.7 mm (3/16") hemmed return. Fixing face to be knurled and have pre-punched pass through holes for services. Length to suit, minimum splicing allowed.

- .2 Widths: 152 mm and 203 mm as scheduled and/or required.
- .3 Gauges: Interior wall steel studs and furring: Use 20 gauge interior wall studs for all partitions. Interior door jamb boxed studs: minimum 0.84 mm thickness. Use heavier gauge studs at supported loads such as washroom accessories and where equipment is attached to wall framing to ensure adequate stiffness of wall framing at supported loading.
- .4 Lengths: 2 400 mm to limiting heights as per manufacturers recommended allowable height tables.
- .5 Colour coded for thickness in accordance with CSSBI Lightweight Steel Framing Manual, Appendix 'B'.

Gauge		Metric Thickness	Colour Code
25		0.46	black
20	light	0.84	red
20	structural	0.91	white
18		1.22	yellow
16		1.52	green
14		1.91	orange
12		2.28	blue
- .6 Metal channel stiffener: 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .7 Stud Fasteners: Manufacture's standard, suitable for intended application.
- .2 Floor and Ceiling Track: Light gauge floor and ceiling track for support and location of steel studs in interior non-load bearing partitions. Track legs slightly tilted in to provide firm clamping force when studs are inserted. Legs to be hemmed.
 - .1 Conforming to CAN/CGSB 7.1-98, Lightweight Steel Wall Framing Components.
 - .2 U-shaped hot dipped galvanized steel having a coating as specified for steel studs.
 - .3 Paint all exposed deflection tracks matte black.
 - .4 Roll formed from ASTM A446, Grade 'A' steel or ASTM A527.
 - .5 Nominal base thickness before galvanizing, 0.46 mm, 0.84 mm.
 - .6 Leg height minimum 32 mm.
 - .7 Use deep leg channel for deflection tracks at all walls extending to underside of floor or roof structure.
 - .8 Hemmed edges.
 - .9 Track width: to equal stud width.
 - .10 Lengths: to manufacturer's standard.
 - .11 Use one gauge heavier deflection track than gauge of stud framing and inset track.
- .3 Furring Channels: Commercial steel sheet in accordance with ASTM A653, Z180, hot dipped zinc-coated (galvanized), as follows:

- .1 Hat Shaped, Rigid Furring Channels: ASTM C645, 0.75 mm thickness x 22 mm deep.
- .2 Resilient Furring Channels: 0.46 mm thickness x 13 mm deep members designed to reduce sound transmission having asymmetrical face attached to single flange by a slotted leg (web).
- .4 Furring Channels
 - .1 'Hat' shaped light gauge steel furring member for screw attachment of gypsum board or veneer plaster baseboard. Knurled face channel. For interior use as furring on concrete surfaces, as furring under steel joists and cross furring in suspended ceilings. Hemmed flanges.
 - .1 Conforming to CAN/CGSB-7.1-98 standard for cold formed steel framing components.
 - .2 Roll formed from 0.46 mm hot dipped galvanized steel having Z120 zinc coating to ASTM 525.
 - .3 Weight 0.45 kg/m.
 - .4 Dimensions overall width 68.2 mm or 66.7 mm, face width 35 mm depth 22.2 mm.
- .5 Metal channel stiffener: 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .6 Insulating strip: rubberized, moisture resistant 1/8" (3 mm) thick foam strip, 1/2" (12 mm) wide, with self-sticking adhesive on one face, lengths as required.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.

3.2 INTERIOR STEEL STUD FRAMING ERECTION

- .1 See wall legend for partition types. Allow for full height partitions between adjacent rooms and along corridors. Minor framing in the same room to run above ceiling level and be braced back to full height walls. Maintain clearance under beams, structural decks, and floor framing to avoid transmission of structural loads to studs. Use double track slip joint with deep channel applied to structure.
- .2 Install track at floor and ceiling. Accurately align according to partition layout. Secure at maximum 600 mm centres using concrete stub nails, shielded screws, power driven or other suitable fasteners.
- .3 At partition corners extend one runner to end of corner and butt other runner. Allow clearance for wallboard thickness.

- .4 Fix studs to tracks with screws.
- .5 Install steel studs vertically at maximum 600 mm centres and not more than 50 mm from abutting walls, openings and each side of corners and terminations with dissimilar materials. Splice studs where necessary by boxing and lap minimum 20 mm, fasten with two screws or rivets per stud flange located not more than 25 mm from ends of splice.
- .6 Stud height and spacing limitations in accordance with stud manufacturer's recommendations.
- .7 Install additional studs as detailed, or as required at all partition intersections, openings or terminations with dissimilar materials. Place studs not more than 50 mm from abutting walls, openings and each side of corners.
- .8 Splice studs together as necessary where horizontal runs of service lines are to be installed and if standard openings in studs are too small for service lines. Splice piece to be minimum 300 mm longer than height of the cut-out.
- .9 Reinforce and frame all openings in steel stud partitions to adequately support loads by using additional framing members and/or bracing and as recommended by stud manufacturer.
- .10 Frame openings on four sides and reinforce as required for all recessed items in steel stud walls and partitions, ceiling drops and suspended wallboard including but not necessarily limited to; mechanical and electrical equipment, electrical cabinets and boxes, fire hose cabinets, light fixtures, diffusers and other recessed equipment as indicated or required. Extend framing into reveals. Check clearances with equipment suppliers.
- .11 Provide and install 0.84 mm thick doubled steel studs at each side of all door openings and other openings in interior steel stud partitions. Extend 0.84 mm studs on each side of door openings from floor to underside of structure over. Fix to runner channel with screws.
- .12 Install runner channels at head and/or sill at window and door openings to accommodate intermediate studs. At each end of runner channel, cut out flanges, turn up web and screw to studs. Install intermediate studs above and/or below openings in same manner and spacing as above.
- .13 Screw fix pressed steel door frame anchor clips to jamb and header framing. Fix to form a positive and rigid installation to prevent movement of frames relative to stud.
- .14 Install doubled studs each side of openings in walls where openings are more than one stud space. Fasten studs together to act as a single structural unit.
- .15 Install double service walls at locations shown on drawings. Erect double parallel row of steel studs set in floor and ceiling track at 600 mm centres using conventional methods. Provide cross ties or bracing between studs where required. Install ties at centre and quarter points by screw attaching to steel studs. Coordinate erection of partitions to suit installation of services.

- .16 Install heavier gauge studs at supported loads such as washroom accessories to ensure adequate stiffness of wall framing at supported loading. 1500 N minimum force to be supported by grab bars.

3.3 FURRING

- .1 Provide vertical and horizontal furring studs and hangers as detailed and as required for gypsum board finishes for furred concrete masonry walls and suspended ceilings as scheduled. Secure furring to structure.
- .2 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixtures.
- .3 Space furring studs at maximum 400 mm centres. Attach horizontal furring channels securely to adjacent structure or wall framing. Attach vertical furring channels less than 100 mm from abutting walls.
- .4 Furr from floor to above suspended ceilings to form return air plenum areas as indicated. Cap shafts and form openings for return air ductwork.

3.4 BACKING AND REINFORCING

- .1 Provide and install all backing and reinforcing within interior steel stud walls for items being hung from or anchored to walls. Provide 92 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .2 Backing or reinforcing as detailed or as recommended by the manufacturer of steel stud system for each type and weight of item.
- .3 Attachments for securing mechanical and electrical service outlets supplied and installed by respective trades.

3.5 ACCESS PANELS

- .1 Install access panels in wallboard furred areas and partitions where indicated or required for access to services.
- .2 Coordinate the work and prepare openings and install access panels in steel stud walls, partitions and ceilings. Access panels supplied by others.

3.6 ACOUSTICAL TAPE

- .1 Install foam gasket tape compressed in joint between top of track at sound rated partitions and acoustic tile ceilings. Apply gasket to top of track before placing in position against ceiling.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.

- .2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 08 11 00 – Metal Doors and Frames: Doors and Frames to be site painted.
- .2 Section 09 21 16.08 – Gypsum Board Assemblies for Minor Works: Gypsum board finish to be site painted.

1.2 REFERENCE STANDARDS

- .1 Environmental Protection Agency (EPA)
 - .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, EPA Method 24 - Surface Coatings.
 - .2 SW-846, Test Method for Evaluating Solid Waste, Physical/Chemical Methods.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .2 Maintenance Repainting Manual - current edition.
- .4 National Research Council Canada (NRC)
 - .1 National Fire Code of Canada 2015 (NFC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's instructions, printed product literature and data sheets for paint and paint products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Confirm products to be used are in MPI's approved product list.
 - .3 Upon completion, provide records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour number[s] .
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).
 - .6 MPI #

- .3 Certificates: Provide certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties. MPI Gateway #.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Provide operation and maintenance data for painting materials for incorporation into manual.
- .3 Include:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour number[s] .
 - .4 MPI Environmentally Friendly classification system rating.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.6 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces in accordance with Section 01 50 00 – Temporary Facilities and Controls.
 - .2 Co-ordinate use of existing ventilation system with Owner and ensure its operation during and after application of paint as required.
 - .3 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
 - .2 Test concrete, masonry and plaster surfaces for alkalinity as required.
 - .3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.
- .3 Additional application requirements:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint in occupied spaces during silent hours only. Schedule operations to approval of Owner such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

- .1 Only paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems: to be products of single manufacturer.
- .3 Conform to latest MPI requirements for painting work including preparation and priming.
- .4 Only qualified products with E2 "Environmentally Friendly" rating[s] are acceptable for use on this project.

2.2 COLOURS

- .1 Match existing colours.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Consultant's written permission.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	85	

- .2 Gloss level ratings of painted surfaces to match existing.

2.5 INTERIOR PAINTING SYSTEMS

- .1 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.
 - .1 INT 5.3M - High performance architectural latex G5 (over W.B. galvanized primer) finish, premium grade.
- .2 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
 - .1 INT 9.2M - Institutional low odour/low VOC finish.

Part 3 Execution**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual and MPI - Maintenance Repainting Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.4 PREPARATION

- .1 Protection of in-place conditions:
 - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Consultant.
 - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .3 Protect factory finished products and equipment.

- .2 Surface Preparation:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
 - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Owner.
 - .4 Clean and prepare surfaces in accordance with MPI - Maintenance Repainting Manual and MPI - Architectural Painting Specification Manual specific requirements and coating manufacturer's recommendations.
 - .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
 - .6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
 - .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
 - .8 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.
 - .9 Touch up of shop primers with primer as specified.

3.5 APPLICATION

- .1 Paint only after prepared surfaces have been accepted by Consultant.
- .2 Use method of application approved by Consultant.
 - .1 Conform to manufacturer's application recommendations.
- .3 Apply coats of paint in continuous film of uniform thickness.
 - .1 Repaint thin spots or bare areas before next coat of paint is applied.
- .4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .5 Sand and dust between coats to remove visible defects.
- .6 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

- .7 Finish inside of cupboards and cabinets as specified for outside surfaces.
- .8 Finish closets and alcoves as specified for adjoining rooms.
- .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.
- .10 Mechanical/Electrical Equipment:
 - .1 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.
 - .2 Do not paint over nameplates.
 - .3 Keep sprinkler heads free of paint.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 **Work** in Division 20, 21, 22 and 23 will include **all** drawings and **all** sections of the specifications that form the Contract Documents, including all addenda, and including Division 00 and Division 01, whether defined in Division 20, 21, 22 and 23 or elsewhere, or whether defined in mechanical drawings or elsewhere.
- .2 Provide complete, fully tested and operational mechanical systems to meet requirements described herein and in complete accord with applicable codes and ordinances. Include all costs to obtain all permits and to pay for all fees and charges, including inspection charges by the authorities that issue the permits; coordinate all related inspections. Permits, fees and inspections including sprinklers, fire protection, third party engineering fees, ventilation, water treatment, building HVAC, C.S.A, plumbing, and any electrical and structural for items provided by mechanical .
- .3 Contract documents of the Specifications and Drawings, are generally diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.
- .4 Review Contract Documents and notify the Consultant of issues of conflict that require clarification prior to submitting tender. Failure by the Contractor to secure clarification does not relieve the Contractor to comply with the intent of the design and/or the Contract Document.
- .5 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents. Provide adequate access space for maintenance and service, and clearances required by code and by the Authority.
- .6 Install material and equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment as determined by the Consultant.
- .7 Unless specified otherwise, the Owner shall be responsible for routine maintenance defined by the manufacturer's instructions during the warranty period. The Owner will be responsible for supplying replaceable components such as filters during the warranty period.
- .8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, assemble, move in place and install complete; start-up and test. Refer to Section 20 05 02 and other Divisions for owner supplied equipment and equipment furnished by other divisions.

1.2 RELATED REQUIREMENTS

- | | | |
|----|--|-------------|
| .1 | Procurement and Contracting Requirements | Division 00 |
| .2 | General Requirements | Division 01 |

1.3 RELATED WORK SPECIFIED IN OTHER DIVISIONS

- | | | |
|----|---|-----------------------------|
| .1 | Bidding Requirements and General Conditions of Contract | Division 00 and Division 01 |
| .2 | Electric Motor Power Characteristics | Division 26 |

1.4 CODES, REGULATIONS, PERMITS, FEES AND INSPECTIONS

- .1 Conform to the edition and supplements specified in Division 01 and where not specified to the latest edition and supplements of the following for all materials and installations:
- .1 National Building Code, as amended by local bylaws and Provincial Statutes.
 - .2 National Energy Code for Buildings, 2020
 - .3 ASHRAE 90.1.
 - .4 National Fire Protection Association.
 - .5 National Fire Code.
 - .6 National Plumbing Code.
 - .7 Codes, Standards, Bylaws, Statutes and Manufacturer's Association Specifications or instructions mentioned in Division 20, 21, 22 and 23 sections, refer to latest revisions thereof at time of calling of bids, unless specifically designated otherwise.
 - .8 In no instance shall the standard established by the drawings and specifications be reduced by code or otherwise.
 - .9 Where conflict or discrepancies between Codes, Standards, Bylaws, Statutes, Specifications, Drawings, etc., exist, the most stringent requirement to apply.
 - .10 Furnish all notices, obtain all necessary permits related to Division 20, 21, 22 and 23 work.

1.5 INSTALLATION REQUIREMENTS

- .1 Install material and equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment as determined by the Consultant. Field verify all dimensions, clearances, maintenance clearances, equipment handling requirements, invert elevations, and other similar measurements prior to any fabrication and installation. Notify the Consultant of any discrepancies that require resolution.
- .2 Install piping and ductwork only in concealed spaces, unless otherwise approved.
- .3 Remove and replace improperly installed mechanical work, or work that requires modifications due to coordination issues or conflicts.
- .4 Examine contract documents prepared by all disciplines and confirm that work can be installed as defined. No allowance will be made for changes unless the consultant has been notified in writing prior to tender close.

- .5 Prepare dimensioned drawings showing sleeving, recesses, furring and openings to coordinate mechanical work with other trades.
- .6 Prepare dimensioned drawings for congested areas that require special attention to complete the installation.
- .7 Make all piping connection to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Install shut-off valves, vents, drains, unions, flanges, traps, fittings. Uncrate equipment, assemble, move in place and install complete; start-up and test. Refer to Section 20 05 02 for owner supplied equipment and equipment furnished by other divisions.

1.6 PROVISIONS FOR MAINTENANCE

- .1 Install piping in racks with clearance in between pipes equal to the pipe diameter. Where piping is stacked, provide a minimum 12" (300 mm) clearance in between stacks.
- .2 Install maintainable components such as valves, motors, traps, dampers, filters, coils in a manner to facilitate proper access for maintenance.
- .3 Install piping connections with isolating valves located to allow component removal with minimal system drainage.
- .4 Locate flanges/unions to allow equipment removal without interruption to piping work.
- .5 Allow adequate space for removal of equipment and components from the mechanical room space.
- .6 Install gauges and metering equipment in readily accessible and visual locations.
- .7 Provide extensions to grease cups, lubrication fittings for bearings, etc. to outside of fan cabinets.
- .8 Allow minimum clearance in front of electrical components, such as motor control centres, starters, VFDs, control panels in accordance with applicable codes.

1.7 WARRANTY

- .1 Comply with warranty requirements defined in Division 01.
- .2 Furnish a written guarantee stating that all work executed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of substantial performance of work. The Contractor shall repair and replace any work which fails or becomes defective during the term of the guarantee/warranty, providing the operating and maintenance instructions have been complied with. The period of guarantee specified shall not, in any way, supplant any other guarantees of a longer period provided by Manufacturers or as called for in the project documents.

1.8 OWNER REQUIREMENTS DURING WARRANTY

- .1 Unless specified otherwise the Owner shall be responsible for all routine maintenance requirements as required in the manufacturer's instructions.

- .2 The Owner shall be responsible for supplying filters, grease and belts.

1.9 MATERIALS

- .1 Materials and equipment installed shall be new, full weight and of quality specified. Use same brand or manufacturer and model for each specific application.
- .2 Each major component of equipment shall bear manufacturer's name, address, catalogue and serial number in a conspicuous place.
- .3 Replace materials or workmanship below specified quality and relocate work wrongly placed to satisfaction of the Consultant and at no cost to the Owner.
- .4 Install materials and equipment in a quality manner providing good workmanship by competent tradesmen.

1.10 AVAILABILITY OF EQUIPMENT AND MATERIALS

- .1 Make known in writing to the Consultant ten (10) days prior to the tender closing date any materials specified that are required to complete the work which are not locally supplied, or are not currently available or will not be available for use as called for herein. Failing to do so, it will be interpreted that the most expensive alternate has been included in the tender price.

1.11 ALTERNATE MATERIALS AND EQUIPMENT

- .1 Comply with requirements in Division 01.
- .2 The price submitted for this contract shall be based on the use of materials and equipment as specified or as contained within the acceptable manufacturers listed in each section.
- .3 Requests for approval for tendering purposes of alternative materials or equipment shall be submitted in duplicate to the Consultant no later than fourteen (14) working days prior to the closing date of tender for mechanical trade, complete with all applicable technical data, including performance curves and physical details. Approval of requests shall only be given by addendum and consistent with all requirements defined in Division 01.
- .4 The Contractor shall, in his quotation, indicate the degree of approval obtained from the Consultant. In the event that the product has been approved as an "Alternate Only", this shall be stated in the quotation and the difference from the base bid price indicated.
- .5 Approved alternatives to specified products shall be equal or better in performance and materials to the specified product in every respect, operate as intended, meet the space, capacity, and noise requirements outlined.
- .6 The Contractor shall be fully responsible for all costs for work or materials required by the trades or other contractors to accommodate use of other than specified materials or equipment including redesign costs.

1.12 PROJECT UNITS OF MEASURE

- .1 The project is expressed in metric units.
- .2 Soft and hard metric conversions are used interchangeably throughout.

- .3 Submit all shop drawings and maintenance manuals in SI units of the same measure as used in the design.
- .4 Equivalent Nominal Diameters of Pipes - Metric and Imperial
 - .1 Where pipes are specified with metric dimensions provide equivalent nominal Imperial sized pipe as indicated in the table.
 - .2 Where equipment is supplied with metric sizing, provide adapters to ensure compatible connections to all metric sized fittings, equipment and piping.

EQUIVALENT NOMINAL DIAMETERS OF PIPES

mm	Inches	mm	Inches	mm	Inches
3	1/8	50	2	250	10
6	1/4	65	2-1/2	300	12
10	3/8	75/80	3	375	15
13/15	1/2	100	4	450	18
19/20	3/4	125	5	500	20
25	1	150	6	600	24
32/30	1-1/4	200	8	750	30
35/40	1-1/2				

- .5 Metric Duct Sizes
 - .1 The metric duct sizes are expressed as 25 mm = 1 inch.

1.13 DRAWINGS AND SPECIFICATIONS

- .1 The responsibility and scope of each subtrade rests solely with the Construction Manager or General Contractor. Extras will not be considered based on the grounds of difference in interpretation of specifications as to which trade involved is to provide certain specifications or materials.
- .2 Refer to drawings for building dimensional data and construction details.
- .3 Drawings and specifications are complementary each to the other, and what is called for by one shall be binding as if called for by both.
- .4 Drawings are diagrammatic and show intent only. Any sections and 3D views are to show spatial clarity only and are not intended to show the complete installation.
- .5 Should any discrepancy appear between drawings and specifications which leaves the Contractor in doubt as to the true intent and meaning of the plans and specifications, obtain clarification from the Consultant by Addendum, before submitting tender. If this is not done, it will be assumed that the most expensive alternate has been included.
- .6 Where errors or discrepancies appear in catalogue numbers, provide the material in accordance with the system requirements and to the standard of the specifications.
- .7 Prior to construction start, examine all contract documents, including all drawings and specifications, and work of other trades to ensure that work can be satisfactorily carried out without changes to building.

- .8 The scope of work in this division shall include all work defined in the Contract Documents, including work which may exceed the minimum requirements of codes and standards that are referenced in the Contract Documents.

1.14 COORDINATION OF WORK

- .1 Cooperate and coordinate with other trades on the project. Phase work in sequence with the Construction Manager or General Contractor.
- .2 Make reference to all available electrical, mechanical, structural and architectural drawings for the project when setting out work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided and symmetrical even spacing is maintained. Provide coordination drawings showing the work of all trades and contractors involved, in areas of potential conflict or congestion, as requested by Consultant at no additional cost.
- .3 Where dimensional details are required, work with the applicable existing architectural and structural drawings.
- .4 Full size and detailed drawings shall take precedence over scale measurements from drawings.
- .5 Prepare and submit drawings showing sleeving, recesses, and formed work in concrete.
- .6 Prepare and submit drawings for all shafts, duct openings, louvre openings and similar requirements.
- .7 Coordinate with the Construction Manager and Electrical Trade all requirements for electrical services to mechanical components and equipment. Motor voltages will be defined in Division 26.
- .8 Using shop drawing data, prepare a comprehensive list to define all specific electrical requirements needed by the Division 21, 22 and 23 work to complete the installation. Coordinate with Electrical Trade. Submit an updated list monthly.
- .9 Prepare and submit drawings to the Construction Manager and structural engineer defining mechanical system support loads and support details. Include definition of pipe and/or loads on structural elements and anchor arrangements.

1.15 CUTTING AND PATCHING

- .1 Provide inserts, holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.
- .2 Provide inserts or drill for expansion bolts, hanger rods, brackets, and supports.
- .3 Obtain written approval from Structural Engineer before drilling, coring, cutting or burning structural members.
- .4 Patch and make good building where damaged from equipment installation, improperly located holes etc. Work to be performed by the trade or contractor responsible for that type of work.

1.16 CERTIFICATE OF SUBSTANTIAL PERFORMANCE

- .1 Comply with Division 00 and Division 01.

- .2 For phase completion requirements, see Division 00 and 01. For phased completion, all requirements of substantial completion to be complete within area of acceptance.
- .3 In addition to the requirements of Division 00 and Division 01, and prior to application for a "Certificate of Substantial Performance" of the work, the contractor shall certify the following in writing to the Consultant:
 - .1 The systems are installed and suitable for operation for the purpose intended.
 - .2 Heating and ventilation systems are capable of operation with safety devices and alarm controls functional and automatic controls in operation and the owners personnel have had their initial training programs.
 - .3 All equipment within mechanical rooms is installed.
 - .4 All fans, and equipment are installed and electrical connections made.
 - .5 All contractor system start-up and test sheets have been completed and submitted for review.
 - .6 All fire stop flaps, fire dampers, and smoke dampers are installed and checked for operation; submit report.
 - .7 All ducted supply/return/exhaust grilles are installed.
 - .8 All supply air, return air, exhaust air, fresh air ductwork is installed and cleaned.
 - .9 All thermal and acoustic insulation is installed.
 - .10 All static pressure tests are complete.
 - .11 All access doors are suitably located, and equipment easily accessible including plumbing cleanouts.
 - .12 All piping is installed, painted and clearly identified complete with flow arrows.
 - .13 All equipment is checked for operation, alignment amperage draw and rotation.
 - .14 Air and water systems balance is completed and the reports have been submitted for review.
 - .15 All equipment is lubricated as per manufacturer's data.
 - .16 All necessary tests and start-up procedures on equipment have been made, including those required by authorities.
 - .17 The building control system seven (7) day acceptance test has been successfully completed.
 - .18 Documentation required by the following sections has been submitted:
 - .1 General Documentation Section 20 05 05
 - .2 Systems Demonstration and Owner's Instruction Section 20 05 06
 - .19 Following information has been submitted:
 - .1 Mechanical Contractor shall certify (by sign-off) that each deficiency listed in all inspection reports has been corrected, or defined as a seasonal deficiency with a cost allowance.
 - .2 Final draft of O&M Manuals.

- .3 Final certificates from authorities having jurisdiction.
- .4 System cleaning reports.
- .5 Reports from manufacturer on noise and vibration control devices, where specified.
- .6 Completed record drawings.
- .7 Vendors equipment start-up reports in related sections and as required in Section 20 05 05, General Documentation.
- .20 Training Seminars for all systems is complete.
- .4 Identify any systems which cannot be installed and/or placed in operation for reasons beyond the normal control of the contractors and submit a statement of the value of the remaining work required to complete the project.
- .5 Within ten (10) working days of receipt of a written application for a "Certificate of Substantial Performance", the Consultant shall visit the site to confirm that all requirements listed in Article 1.18.3 are complete. Mechanical Contractor shall attend this site review and provide a copy of the O&M Manual.
- .6 If, after the Consultant site visit the application for a "Certificate of Substantial Performance" is not approved, the contractor shall reapply in accordance with the Consultant site visit report and pay for costs of re-inspection services.
- .7 The Consultant shall provide one (1) visit for the purpose of reviewing the application for a "Certificate of Substantial Performance". Subsequent visit(s) if required, shall be at the expense of the contractor.

1.17 CERTIFICATE OF TOTAL PERFORMANCE

- .1 Comply with the requirements of Division 00 and Division 01.
- .2 Prior to application for a statement of "Total Performance", the Contractor shall certify the following in writing to the Consultant:
 - .1 All items noted in previous site visit reports including that performed for Substantial Performance have been completed.
 - .2 All controls have been calibrated and set.
 - .3 Warranty forms are mailed to manufacturer. (Provide copy of original warranty for equipment which has a warranty period of longer than one year).
 - .4 All equipment has been aligned by qualified millwrights where specified.
 - .5 Temporary filters are removed and permanent filters are installed.
 - .6 Completed and accepted Operating and Maintenance (O&M) Manuals have been submitted to Owner.
 - .7 Completed and accepted final air and water Balancing Reports have been included in the O&M Manuals.
 - .8 The Owner has received instructions in the operation and maintenance of the system.
- .3 Within ten (10) working days after receipt of a written application for a "Certificate of Total Performance", the Consultant shall visit the site.

- .4 The Consultant shall provide one (1) visit for the purpose of reviewing the application for a "Certificate of Total Performance". Subsequent visit(s) if required, shall be at the expense of the contractor.

1.18 SHOP DRAWINGS

- .1 To requirements of Division 01.
- .2 Submit shop drawings in electronic (PDF) format compatible with ISO 32000-1:2008 Document Management, complete with appropriate cover sheets, transmittals and stamps. Shop drawings are to be submitted by spec section only. Provide a sample of a cover sheet for approval by Consultant. Shop drawings will be returned if the cover sheet is not provided.
- .3 Prior to submission to the Consultant, the Contractor shall review all shop drawings. By this review, the Contractor certifies that he has determined and verified the following:
 - .1 Measurements are verified with field installation space requirements.
 - .2 "Handling" of equipment for access and maintenance is correct.
 - .3 Access for maintenance requirements is defined.
 - .4 Field connections for wiring, controls, piping and ductwork connections are defined.
 - .5 Electrical service connections and characteristics are defined.
 - .6 Work required by other trades is defined.
 - .7 Vendor's catalogue numbers are correct and consistent with the system performance criteria.
 - .8 Shop drawings meet all requirements of the contract documents.
- .4 The Contractor's review of each shop drawing shall be indicated by stamp, date and signature of a responsible person.
- .5 Identify materials and equipment by manufacturer, trade name, and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Consultants office. Maintenance and operating manuals are not suitable submittal material and will be marked "not reviewed". Where equipment is identified by name or number on the drawings or specification, clearly mark each shop drawing with the identical name and/or number.
- .6 Clearly mark each sheet of submittal material (using arrows, underlining, or circling) to show differences from what is specified, particularly sizes, types, model numbers, rating, capacities, and options actually being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pump seals, materials or painting.
- .7 Include dimensional and technical data sufficient to check if equipment meets requirements. Include wiring, piping, service connection data and motor sizes.
- .8 Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Consultant.

- .9 The shop drawing review by the Consultant will provide the following certification:
"Review by Building Systems Engineering is for the sole purpose of ascertaining general conformity with design. Contractor is responsible for dimensions, fabrication and construction methods, coordination of subtrades, detail design of components, and errors or omissions on shop drawings."

1.19 TEMPORARY HEATING AND COOLING

- .1 Refer to Division 1.
- .2 Contractor is responsible for providing temporary heating as necessary to the building for the duration of the project, up until substantial completion. Occupied areas to be maintained above 18C at all times unless approved by owner in advanced.
- .3 Prior to the use of the building systems for temporary heat the contractor shall provide a proposed temporary heat agreement for review and approval.
- .1 The agreement shall include payment schedule for utilities, spare parts listing and confirmation of warranty.
- .2 Submit for approval a minimum 60 days prior to intended use of permanent systems for temporary heating.
- .3 The propane tanks must be commissioned and approved for use with final permits approved and submitted to owner. Allow for 3 weeks from final approval for filling of tanks. Cost for propane supplied from permanent tanks to be paid by owner. Cost for ancillary systems by contractor.
- .4 Use of permanent systems for temporary heating or cooling shall only occur on submissions of agreement and written consent of the agreement by the Owner.
- .5 Operate heating systems under conditions which ensure no temporary or permanent damage. Operate with proper safety devices and controls installed and fully operational.
- .6 Where pumps are used for temporary heating, replace mechanical seals, regardless of condition, with new mechanical seals, prior to Total Performance.
- .7 When permanent systems are used for temporary heat, provide alarm indicating system failure. Connect alarm to independent alarm company monitoring system.
- .8 Avoid thermal shock to heating system during planning, construction and operation of temporary heating system.

1.20 FIRESTOPPING

- .1 General: Firestopping to be completed in accordance with Division 7 and schedule below with listed intumescent sealant to manufacturer's and cUL listings for rated assembly penetration. Provide manufacturer's cUL shop drawing details for every different rated assembly penetration. Jobsite conditions of each through penetration firestop system must meet ALL details of the cUL-Classified System selected. If jobsite conditions do not match any cUL-classified systems in the schedules below, contact manufacturer for alternative systems. Coordinate work with other trades to assure that penetration opening sizes are appropriate for penetrant locations.

- .2 All piping/duct penetrations through 45 minute rated assemblies to be cold smoke sealed/fire sealed with listed intumescent sealant or approved cold smoke sealed at fire penetrations to sealant cUL listing.
- .3 Intumescent sealant:
 - .1 ULC/FM listed flexible intumescent sealant suitable as fire and smoke sealant.
 - .2 Standard of Acceptance: Hilti FSone
- .4 Intumescent Fire Stop Collars:
 - .1 ULC/FM listed with galvanized metal collar, intumescent fire sealant for use with PVC and ABS schedule 40 DWV piping.
 - .2 Standard of Acceptance: Hilti CP 642/643.
 - .3

SCHEDULE OF HILTI THROUGH PENETRATION FIRESTOP SYSTEMS

CONCRETE FLOORS		
<u>TYPE OF PENETRANT</u>	<u>F-RATING (HR)</u>	<u>CUL-CLASSIFIED SYSTEM</u>
CIRCULAR BLANK OPENINGS	1	CAJ 0055, CAJ 0070
	2	CAJ 0055, CAJ 0070
	3	CAJ 0055
SINGLE METAL PIPES	1	CAJ 1226, CAJ 1184
	2	CAJ 1226, CAJ 1184
	3	CAJ 1226, CAJ 1184
	4	CBJ 1037, CBJ 1034
SINGLE NON-METALLIC PIPE (i.e. PVC, CPVC, ABS, FRP, ENT)	1	FA 2025, CAJ 2109, CAJ 2098, CAJ 2141, CAJ 2167, CBJ 2021
	2	FA 2025, CAJ 2109, CAJ 2098, CAJ 2141, CAJ 2167, CBJ- 2021
	3	CAJ 2109, CAJ 2098
SINGLE INSULATED	1	CAJ 5090, CAJ 5091, CAJ 5098

PIPES	2	CAJ 5090, CAJ 5091, CAJ 5098
	3	CAJ 5090
	4	CBJ 5006
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	CAJ 7046, CAJ 7051
	2	CAJ 7046, CAJ 7051
	3	CAJ 7046, CAJ 7051
MIXED PENETRANTS	1	CAJ 8041, CAJ 8056
	2	CAJ 8041, CAJ 8056
	3	CAJ 8041, CAJ 8056
	4	CBJ 8010
CONCRETE OR BLOCK WALLS		
<u>TYPE OF PENETRANT</u>	<u>F-RATING (HR)</u>	<u>CUL-CLASSIFIED SYSTEM</u>
CIRCULAR BLANK OPENINGS	1	CAJ 0055, CAJ 0070
	2	CAJ 0055, CAJ 0070
	3	CAJ 0055
SINGLE METAL PIPES	1	CAJ 1226, WJ 1021
	2	CAJ 1226, WJ 1021
	3	CAJ 1226, WJ 1041, WJ 1042
	4	CBJ 1034, CBJ 1037, WJ 1041, WJ 1042
SINGLE NON-METALLIC PIPE (i.e. PVC, CPVC, ABS, FRP, ENT)	1	CAJ 2109, CAJ 2098, CAJ 2167
	2	CAJ 2109, CAJ 2098, CAJ 2167
	3	CAJ 2109, CAJ 2098
	4	WJ 2057
SINGLE INSULATED PIPES	1	CAJ 5090, CAJ 5091, CAJ 5061

	2	CAJ 5090, CAJ 5091, CAJ 5061
	3	CAJ 5090, CAJ 5061
	4	CBJ 5006, WJ 5028
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	CAJ 7046, CAJ 7051, WJ 7021, WJ 7022
	2	CAJ 7046, CAJ 7051, WJ 7021, WJ 7022
	3	CAJ 7046, CAJ 7051
MIXED PENETRANTS	1	CAJ 8041, CAJ 8056, WJ 8007
	2	CAJ 8041, CAJ 8056, WJ 8007
	3	CAJ 8041, CAJ 8056, WJ 8007
	4	CBJ 8010, WJ 8007
WOOF FLOOR		
<u>TYPE OF PENETRANT</u>	<u>F-RATING (HR)</u>	<u>CUL-CLASSIFIED SYSTEM</u>
METAL PIPES	1	FC 1009, FC 1059
	2	FC 1009, FC 1059
NON-METALLIC PIPE	1	FC 2025, FC 2030, FC 2160
	2	FC 2025, FC 2029, FC 2128
INSULATED PIPES	1	FC 5004, FC 3036, FC 3037
	2	FC 5004, FC 3036, FC 3037
NON-INSULATED MECHANICAL DUCTWORK	1	FC 7013
WITHOUT DAMPERS MIXED PENETRANTS	1	C 8009, FC 8014
GYPSUM WALLBOARD ASSEMBLIES		
METAL PIPES	1	WL 1054, WL 1058, WL 1164
	2	WL 1054, WL 1058, WL 1164
	4	WL 1110, WL 1111
NON-METALLIC PIPE	1	WL 2078, WL 2075, WL 2128
	2	WL 2078, WL 2075, WL 2128
	4	WL 2184
INSULATED PIPES	1	WL 5028, WL 5029, WL 5047 2 WL 5028, WL 5029, WL 5047
	4	WL 5073
NON-INSULATED	1	WL 7017, WL 7040, WL 7042

MECHANICAL DUCTWORK WITHOUT DAMPERS	2	WL 7040, WL 7042
MIXED PENETRANTS	1	WL 1095, WL 8013
	2	WL 1095, WL 8013
	4	WL 8014

1.21 EQUIPMENT PROTECTION AND CLEAN-UP

- .1 Protect equipment and materials in storage on site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Protect equipment with polyethylene covers and crates.
- .3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.
- .4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.
- .5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

1.22 TEMPORARY OR TRIAL USAGE

- .1 Temporary or trial usage requested by the Owner of mechanical equipment supplied under contract shall not represent acceptance. Operate and maintain all equipment and systems during trial usage.
- .2 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.
- .3 For all ventilation systems, the operation of the system shall be pre-tested by running the units in a 100% fresh air, 100% exhaust air mode once all distribution ductwork is installed. Inspect filters bi-monthly; change filters if pressure drop exceeds manufacturer's recommended operating limit. Where seasonal conditions will not allow test, advise Consultant and request direction.
- .4 During the trial use test of the ventilation system the contractor shall arrange for a sound meter and test sound levels in locations selected by the Consultant.
- .5 The ventilation system trial use date shall be approved by the Consultant.

1.23 COORDINATION WITH DIVISION 26 WORK

- .1 Provide motors or mechanical equipment with voltage and phase characteristics as defined in Division 26.
- .2 Prior to ordering any motor driven mechanical equipment, meet with the electrical trade and they shall confirm all electrical interface requirements with mechanical components.

- .3 Division 20, 21, 22 and 23 (Mechanical) Trade shall:
 - .1 Submit a list of all motor specifications and electrical connections to mechanical equipment, outlets, components, panels and point source requirements. Maintain list up-to-date and make available for site review.
 - .2 Include motor list in O&M Manuals.
 - .3 Supply and set in place all variable frequency drives unless supplied under the Electrical divisions.
 - .4 Supply and install 110 V wiring interface with control devices on packaged equipment, such as liquid level controllers and multi-speed controllers.
 - .5 Provide CSA labeling on all mechanical equipment with electrical components.
 - .6 Provide all on-site interconnecting wiring for connecting loose electrical components supplied with mechanical equipment.
- .4 Division 26 (Electrical) Trade will:
 - .1 Supply and install all electrical components which are required, but not part of Division 20, 21, 22 and 23 supplied packaged equipment.
 - .2 Provide wiring interface from distribution equipment to variable frequency drives (VFDs) and from VFDs to motors.
 - .3 Extend power wiring from electrical centers to packaged equipment that contains electrical components.
 - .4 Refer to Division 26.

1.24 CONTRACT PRICE BREAKDOWN

- .1 Submit a breakdown of the contract price using the following form, or alternate approved by the Consultant and Construction Manager, within thirty (30) days of contract award and well before first progress claim for review and approval by Consultant.
- .2 Contract price breakdowns to be provided for each contracts scope of work as defined by the Construction Manager. Where a breakout is not required a result of the defined scope of work, indicate value as Nil or N/A, Not Applicable.
- .3 Progress claims shall be submitted using this contract price breakdown.

CONTRACT PRICE BREAKDOWN

	MATERIAL	LABOUR
Bonding		
Supervision		
Project Overheads: Shack, Telephone, Housing, etc.		
Documentation		
System Demonstration and Owners Instruction		
Architecural (walls, door, roof patching)		

- Materials Testing
- Equipment Testing and Start-Up
- Contractor Testing and Start-Up
- Balancing
- Cleaning and Chemical Treatment and Equipment
- Roof Work
- Heating
 - Heating Plant
- Ventilation & Air Conditioning
 - Chimneys and Venting
 - Fans
 - Ducts and Dampers
- Insulation
 - Duct Insulation
 - Pipe Insulation
 - Equipment Insulation
- Controls
 - Engineering
 - Materials
 - Labour
 - Startup

MATERIAL

LABOUR

TOTAL (TO EQUAL CONTRACT PRICE)

Part 2 Products
 Not Applicable

Part 3 Execution
 Not Applicable

END OF SECTION

1.1 General

1.2 SCOPE

- .1 Provide rough-in for and make all connections to equipment supplied by others.

1.3 RELATED WORK IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
- | | | |
|----|---------------------------------------|----------------------|
| .1 | General Mechanical Provisions | Section 20 05 01 |
| .2 | Valves and Strainers | Section 20 05 23 |
| .3 | Identification for Mechanical Systems | Section 20 05 53 |
| .4 | Pipe and Pipe Fittings | Section 20 20 10 |
| .5 | Testing, Balancing and Adjusting | Section 20 22 00 |
| .6 | Controls | Section 20 30 Series |
| .7 | Metal Ducts | Section 23 31 13 |
- .2 Refer to other specification sections for complete list of equipment supplied by others.

Part 2 Products

The following table includes scope of work by others: Refer to equipment supplier package including drawings and specs.

Part 3 Execution

3.1 INSTALLATION

- .1 Make all mechanical connections to equipment supplied by others under this contract. This shall include all water, drain, gas, exhaust, controls, traps, ductwork and similar connections required. Provide isolation valves, unions, flanges and traps as required for a complete installation.
- .2 Prior to commencing installation of rough-in for the equipment, coordinate with the final reviewed equipment shop drawings and with the manufacturer. Revise rough-in as necessary to meet requirements of actual equipment purchased.
- .3 All services including piping and duct work to specified requirements. Arrange all connections to allow for equipment removal.
- .4 Equipment supplied by others and required work includes but not limited to:
- | | |
|----|---|
| .1 | Propane tank, tank blankets, vapourizer, and piping up to and including first stage regulator. Tank pad, restraint, electrical connections, and piping by contractor. |
|----|---|

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Consultant at project milestones.
- .2 Operating and Maintenance Manuals
- .3 Record Drawings

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Requirements Division 01
 - .2 General Mechanical Provisions Section 20 05 01
 - .3 Heating, Ventilation and Air Conditioning Division 23
- .2 Closeout Submittals
 - .1 General Requirements Division 01

1.3 QUALITY ASSURANCE

- .1 Work specified in this section shall be performed by an Independent Agency specializing in this type of work.
- .2 Submit sample of work by the Independent Agency prior to acceptance by the Consultant.

Part 2 Products

2.1 OPERATING AND MAINTENANCE MANUALS

- .1 Refer to Division 01.
- .2 Secure and assemble all necessary literature describing the operation and maintenance of all equipment provided. Complete and transmit documentation for review to Consultant at project milestones.

2.2 BINDERS & ELECTRONIC MANUALS

- .1 Refer to Division 01.
- .2 Provide hard copies of Operations and Maintenance Manuals as specified in Division 01.
- .3 Provide electronic manual as specified in Division 01.

2.3 TABS

- .1 Refer to Division 01.
- .2 Divider tabs shall be coloured according to division and section to requirements of Division 01.
- .3 Plastic tabs with typewritten card inserts will not be accepted.

- .4 The colouring for tabs for individual sections is as follows, unless otherwise directed in Division 01:
 - .1 Green - Air Systems
 - .2 Brown - Control Systems
 - .3 Blue - Heating and Cooling Systems
 - .4 Red - Fire Protection
 - .5 Yellow - Miscellaneous Systems
 - .6 Purple - Plumbing Systems

2.4 MANUAL DIVISIONS

- .1 Organize each mechanical manual into the following divisions.
 - .1 Operation Division
 - .2 Maintenance Division
 - .3 Contract Documentation Division

2.5 OPERATIONS DIVISION

- .1 The operations division shall have all data organized into sections according to the system category with individual divider tabs as follows:
 - .1 AIR - Air Systems
 - .2 CTL - Control Systems
 - .3 HTG/CLG - Heating and Cooling Systems
 - .4 MIS - Miscellaneous Systems
- .2 Organize data for each system category (section) into individual sub-systems. Provide an index for each system category and a divider tab for each individual system.
- .3 For each individual sub-system include the following:
 - .1 System Description - Provide details of system type, composition, areas served, location in the building, design criteria and function of major components. All equipment arranged to operate together as one system shall be considered part of that system description.
 - .2 System Schematics
 - .1 Provide individual system schematics for each system listed above.
 - .2 Include mechanical equipment and component design designation.
 - .3 Use these specific naming conventions on all references through the O&M Manual.
 - .3 Operating Instructions - Provide, in "operator" layman language, the specific instructions for startup, shutdown and seasonal change-over of each system component. Include exact type and specific location of each switch and device to be used in the system operation. Identify safety devices and interlocks that must be satisfied in order for the equipment to start. Also, list conditions to be fulfilled before attempting equipment

startup, i.e. valves position correct, glycol mixture concentration proper, piping filled with fluid, filters/strainers in place, etc.

- .4 Equipment Identification - Provide data for each system component.
- .5 Maintenance Division
 - .1 Organize data into the following sections with divider tabs:
 - .1 Maintenance Tasks And Schedules
 - .2 Spare Parts
 - .3 Suppliers And Contractors
 - .4 Tags And Directories
 - .2 Maintenance Tasks and Schedules - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize maintenance tasks from manufacturers maintenance brochures, for each component of each system in the following format:
 - .1 Daily
 - .2 Weekly
 - .3 Monthly
 - .4 Semiannually
 - .5 Annually
 - .6 When Required.
 - .3 Spare Part List - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize from manufacturers maintenance brochures the recommended spare parts for each component of each system.
 - .4 Suppliers and Contractor List - Provide summary of Suppliers and Contractors for each components of each system. List name, address and telephone number of each.
 - .5 Tags and Directories - Provide a copy of the Mechanical Drawing, List, Valve Tag List, Piping Identification Schedule and all other directories as specified in the contract documents.
- .6 Contract Documentation Division
 - .1 Organize all data required by the construction contract into sections, with divider tabs, as follows:
 - .1 Drawings List
 - .2 Shop Drawings and Product Data
 - .3 Certifications
 - .4 Warranties and Bonds
 - .5 Maintenance Brochures
 - .6 Reports

- .2 Shop Drawings and Product Data - Provide final copies of all shop drawings and product data required by the contract documents. Include section index and divider tabs. Maximum of twenty-five (25) sheets or one (1) system shop drawing per tab.
- .3 Certifications - Provide copies of Contractor Certifications for the performance of product and systems. Include copies of all pressure tests for piping and ductwork systems, equipment alignment certificates, local authority inspection reviews, backflow prevention certification, and fire protection certifications. Include section index and divider tabs with maximum of twenty-five sheets (25) or one report per tab.
- .4 Warranties and Bonds - Include one copy each of the Contractor's warranty, manufacturers' warranties longer than one year, the bond, and any service contract provided by the contractor. Provide section index.
- .5 Maintenance Brochures - Include copies of all manufacturers' printed maintenance brochures pertaining to each product, equipment or system. Provide section index and divider tabs. Maximum of twenty-five (25) sheets or one system brochure per tab.
- .6 Reports - Include copies of all reports relating to the testing, adjusting and balancing of equipment and systems, water treatment reports and manufacturer's startup reports, as required by the contract specification sections.
- .7 Submissions and Approvals
 - Draft Submission
 - .1 The draft submission is to be bound in 3 ring loose leaf type binders and shall include the following information:
 - .1 A table of contents for the complete manual.
 - .2 Index of each division of the manual.
 - .3 Index of each section of the operations and maintenance divisions.
 - .4 A draft operations division write-up for a typical system, including sample schematic.
 - .5 A draft maintenance division write-up for the same typical system.
 - .6 Sample proof of binder covers and spines.
 - .2 On completion of review of the draft submission the consultant will return the copy of the manual with review comments for resubmission.
 - .3 The draft shall be complete in all respects, except for reports and certificates to be produced during the facility startup phase. This manual shall have the same physical format, including divider tabs and indices, as the final edition of the manual. This draft may be bound in standard three-ring loose leaf binders.

- .4 The contractor shall update contents of the site copy of the draft manual as new information is generated during the facility startup phase.

Final Edition

- .1 Prior to final acceptance the contractor shall submit four (3) copies of the final edition of the manual plus the digital copies as specified under Div.1.
- .2 This final edition shall include all outstanding project information and conform to all requirements listed in this document.

2.6 RECORD DRAWINGS

- .1 Refer to and comply with Division 01 and Section 20 05 01, General Mechanical Provisions.
- .2 The contractor shall keep, on site, available to the Consultant at all times and particularly for each regularly scheduled site meeting, a complete set of prints, edge bound, that are to be updated daily showing any and all deviations and changes from the Contract Drawings. This set of drawings is to be used only for this purpose, and must not be used as the daily general reference set.
- .3 Provide record drawings which identify location of smoke and fire dampers, major control lines, access doors, tagged valves, and actual room names or numbers. As well, deviations that are to be recorded shall include, in general, items that are significant or are hidden from view and items of major importance to future operations and maintenance, and to future alterations and additions including cleanouts and isolation valves.
- .4 At substantial completion, transfer all deviations, including those called up by addenda, revisions, clarifications, shop drawings, and change orders, to a set of disks to current AutoCAD Version. Drafting quality layers, symbols, etc. shall be identical to original drawings. Prior to substantial performance, turn over a completed set of disks or memory stick and a complete set of printed ½ size record drawings in operations manuals.
- .5 Each “record” drawing shall bear the Contractor’s identification, the date of record and the notation “We hereby certify that these drawings represent the “Work Record of Construction”. The Contractor’s signature and company seal shall be placed below that notation.

Part 3 Execution

3.1 GENERAL

- .1 Submit documents to the Consultant for approval prior to transmitting to the Owner.
- .2 Schedule for a 21 day review period for each of the Draft copy of the Manuals.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Demonstration of equipment and systems operations.
- .2 Instruction and seminars for Owner's personnel.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Requirements Division 01
 - .2 General Mechanical Provisions Section 20 05 01
 - .3 Equipment Testing and Startup Section 20 05 08
 - .4 Controls Section 20 30 Series
 - .5 Heating, Ventilation and Air Conditioning Division 23

1.3 QUALITY ASSURANCE

- .1 Work specified shall be performed by the Contractor and his Subtrades and Suppliers.

Part 2 Products

Not Applicable

Part 3 Execution

3.1 GENERAL

- .1 Arrange for presentation and demonstration of mechanical equipment and systems by appropriate specialists and shall ensure that required manufacturer's representatives are in attendance.
- .2 Coordinate demonstration and instruction agenda and schedule with the Construction Manager and Consultant.
- .3 Coordinate demonstration and instruction agenda and schedule for work performed outside the contract with the Construction Manager and Consultant.
- .4 Provide personnel when necessary to ensure proper detailed training is provided for all mechanical systems.

3.2 DEMONSTRATIONS

- .1 Demonstrate specific starting and stopping and general maintenance requirements for each major piece of equipment. Ensure all labeling and identification is completed.
- .2 Demonstrate the following systems, in the form of instruction seminars and contractor-guided tour of the facility.
 - .1 Heating Systems
 - .2 Control Systems

- .3 Balancing
- .3 Demonstrate the following pieces of equipment and systems.
 - .1 Boiler/Pumps/Hex
 - .2 Propane Systems including all vapourization systems and controls
 - .3 Chemical Treatment Systems
 - .4 Controls
- .4 Refer to sample mechanical system agenda schedules in Item 3.3 following for identifying the proposed sequence of demonstrations. Sequence of demonstration and duration of training seminars to suit project. Submit agenda for review by Consultant one month prior to demonstration.
- .5 A minimum of two 4 hour training sessions to be provided for owner attendance. The two sessions of onsite training to be scheduled over a maximum one week period.
- .6 Answer all questions raised at demonstrations; if unable to satisfactorily answer questions immediately, provide written response within three (3) days.
- .7 Provide sign off sheets for each session. Sign off sheets to have attendees, date, subject, presentation by and comments. Attach the sign off sheets to the agenda and submit a copy to the Consultant following training seminars.

3.3 MECHANICAL SYSTEMS AGENDA (SAMPLE)

Mechanical Systems Agenda

Topic: Heating and Cooling System

Day: .1 **Start Time:** TBD
Meeting Place: _____

Approximate Duration: 4.0 hours

Agenda: .1 Classroom Presentation
.2 Contractor / Supplier: _____
.3 Site Walkthrough
.4 Final Questions and Sign-off Log Sheet

Personnel to be in Attendance:

- .1 Mechanical Contractor and Sub-Contractors (as required)
- .2 Maintenance staff

Presentation Format:

Classroom:

Introduction

- .1 Pass out handouts of system description
- .2 Reference to equipment operation brochures as required.
- .3 Detailed system overview by Mechanical Contractor, Sub-Contractors and Suppliers
- .4 Review of system installations by the Mech. Contractors using record drawings

Site Tour:

- .1 Mechanical Contractor to outline location of equipment, piping runs, valves, service access points.
- .2 Review service procedures for propane and heating equipment.
- .3 Heating units to be reviewed for service and operation.
- .4 Provide written instructions on how to start and stop all equipment and demonstrate using instructions during tour.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Test glycol heating piping.
- .2 Test glycol in-floor heating piping
- .3 Test hot water piping
- .4 Test gas piping.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Requirements Division 01
 - .2 General Mechanical Provisions Section 20 05 01
 - .3 General Documentation Section 20 05 05
 - .4 Pipe and Pipe Fittings Section 20 20 10
 - .5 Cleaning and Chemical Treatment - General Requirements Section 20 21 00
 - .6 Testing, Balancing and Adjusting Section 20 22 00
 - .7 Controls Section 20 30 Series
 - .8 Materials Testing - HVAC Systems Section 23 05 07
 - .9 Plumbing Division 22
 - .10 Heating, Ventilation and Air Conditioning Division 23

1.3 QUALITY ASSURANCES

- .1 Test equipment and material where required by specification or authority having jurisdiction to demonstrate its proper and safe operation.
- .2 Test procedures in accordance with applicable portions of ASME, ASHRAE, SMACNA, NFPA and other recognized test codes.
- .3 Perform tests on site to the satisfaction of the Consultant.
- .4 Piping, ducts, fixtures or equipment shall not be concealed or covered until installation is inspected and approved by the Consultant or written approval to proceed without inspection. Provide written notice to the Consultant at least three (3) days in advance of tests or concealing of piping.
- .5 Coordinate with Consultant at start of the project, those tests that will require witnessing by the Consultant.
- .6 Submit sample test certificate forms for review two (2) weeks prior to any testing on site.

1.4 SUBMITTALS

- .1 Obtain certificates of approval and acceptance, complying with rules and regulations from authorities having jurisdiction. Submit copies to be included in Operating and Maintenance Manuals.

- .2 Perform tests as specified. Include test certificates in Operating and Maintenance Manuals.

1.5 LIABILITY

- .1 Take charge of plant during tests, assume responsibility for damages in the event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration in this connection.

Part 2 Products

Not Applicable

Part 3 Execution

3.1 COSTS

- .1 Bear all costs for testing, making good and retesting.
- .2 Final site tests are not complete until accepted by owner and authority having jurisdiction. No additional payment shall be made for retesting to meet requirement of these parties for acceptance of tests.

3.2 PRESSURE TESTS

- .1 Provide equipment, materials and labour for tests and pay expenses. Use test instruments from approved laboratory or manufacturer and furnish certificate showing degree of accuracy and date of calibration. Install permanent gauges and thermometers used for tests just prior to tests to avoid possible changes in calibration.
- .2 Carry out piping tests for 8 hour period and maintain pressure with no appreciable pressure drop. Where leakage occurs, repair and re-test and pay necessary costs for re-witnessing.
- .3 Closed Loop Piping Systems: Test to 1-1/2 times maximum working pressure or 1035 kPa, whichever is greater, pressure measured at system low point.
- .4 Gas piping: to requirements of CSA B149.1.
- .5 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.
- .6 During heating and cooling piping system tests, check linear expansion at elbows, U bends, expansion joints and offsets for proper clearance.
- .7 When using water as test medium for system not using water or glycol, evacuate and dehydrate the piping and certify the lines are dry. Use agency specializing in this type of work.
- .8 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubbler test for air or nitrogen test medium and halide torch for refrigerant medium.
- .9 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making

joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Performance testing of equipment.
- .2 Manufacturer's startup of equipment.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Requirements Division 01
 - .2 General Mechanical Provisions Section 20 05 01
 - .3 General Documentation Section 20 05 05
 - .4 Demonstration and Owner's Instruction for HVAC Systems Section 23 05 06

1.3 QUALITY ASSURANCE

- .1 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of mechanical equipment and systems being checked and shall be able to interpret results of the readings and tests.
- .2 Use factory trained representatives and submit manufacturer's check sheets for starting of systems and equipment where indicated or where required to ensure integrity of manufacturer's warranty.
- .3 Prior to starting, testing, balancing, adjusting, and cleaning processes, verify with Consultant any tests required to be witnessed. Provide sufficient notice to Consultant prior to commencement of procedures.
- .4 Consultant shall be allowed to witness any testing, adjusting, starting, balancing, and cleaning procedures.
- .5 Assume all costs associated with starting and testing, including the supply of testing or cleaning medium.
- .6 Prior to starting equipment or systems, secure and review manufacturer's installation, operation, and starting instructions. Read in conjunction with procedures defined herein.
- .7 Compare installations to published manufacturer's data and record discrepancies. Items potentially detrimental to equipment performance shall be corrected prior to equipment starting.
- .8 Some processes involved in starting procedures defined in this section may be duplications of authorities verification. To facilitate expedient completion of project, arrange for authorities to assist or witness these procedures.
- .9 All starting, testing, and procedures shall be in accordance with applicable portions of ASME, ASHRAE, AABC, CSA, NFPA, SMACNA, ASTM, ASPE and as required and outlined in these specifications.
- .10 Assume all liabilities associated with starting, testing and balancing procedures.

Part 2 **Products**
Not Applicable

Part 3 **Execution**

3.1 **GENERAL**

- .1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.
- .2 Meet with Division 26 manufacturers, suppliers, and other specialists as required to ensure all phases of work are properly coordinated prior to commencement of each particular testing procedure. Establish all necessary manpower requirements.
- .3 Operate and test motors and speed switches for correct wiring and sequences and direction of rotation. Check and record overload heaters in motor starters.
- .4 Confirm voltages and operating amperages at full load.
- .5 Failure to follow instructions pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by Owner at Contractor's expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from site, and replaced. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.

3.2 **PROCEDURES**

- .1 Procedure shall be identified in the following five (5) distinct phases:
 - .1 Pre-Starting: Visual inspection.
 - .2 Starting: Actual starting procedure.
 - .3 Post-Starting: Operational testing, adjusting or balancing, and equipment run-in phase.
 - .4 Pre-Interim Acceptance of the Work: Final cleaning, re-testing, balancing and adjusting, and necessary maintenance.
 - .5 Post-Interim Acceptance of the Work: Repeat tests and fine-tuning resulting from corrective action of deficiency clean-up.
- .2 Check specified and shop drawing data against installed data.
- .3 Check the installation is as defined by contract documents and as per manufacturer's recommendations including manufacturer's installation check sheets.
- .4 Include for the costs of an independent testing agency, selected by the Owner, to take samples of all chemically treated hydronic systems, perform lab analysis of the chemical treatment levels, and submit a written report of their findings to the Owner. Should chemical treatment levels not meet the requirements of the specifications, the Contractor shall adjust treatment levels accordingly and cover the costs of the independent testing agency to take additional samples and tests.

3.3 CONTRACTOR TESTING RESPONSIBILITIES

- .1 The contractor shall be required to provide the following tests as part of his construction contract. For each test, a test form is to be filled out, witnessed, kept on site for the consultant to verify at any time during construction and then they are to be included in the final submission of the contractor O&M manuals. Equipment included in the testing is limited to new equipment and/or existing equipment modified by the work.
 - .1 Propane Gas Systems
 - .1 Tanks
 - .1 Coordinate with vendor for testing and fill of tanks.
 - .2 Vaporization Systems
 - .1 Start-up all vaporizing system as per manufacturers requirements
 - .2 Adjust system pressure at regulators as per design
 - .3 Confirm operation all safeties and pressure relief devices
 - .4 Verify operation of all heating blankets and vapourizers, record operating electrical voltage and amperage and record values in O&M
 - .5 Configure vapourizer control parameters to achieve specified operation and record all setting in O&M. Coordinate with Div 26.
 - .6 Test all piping in accordance with CSA-B149 and 20 05 07.
 - .7 Record all gas pressure at each appliance prior to starting equipment.
 - .2 Hydronic Heating System
 - .1 Boilers
 - .1 Start-up boilers as per manufacturers recommendations
 - .2 Set up and adjust burner operation through all firing rates, and record efficiencies
 - .2 Pressure Dependent Flow Valves
 - .1 Record pressure drops across each valve
 - .2 See TAB instructions.
 - .3 Pumps
 - .1 Run for 12 hours. (Ensure parallel pumps are equally balanced).
 - .2 Record motor power consumption
 - .3 Calculate pump efficiency
 - .4 Measure specific gravity of fluid
 - .4 Tanks
 - .1 Verify expansion tank level at 20°C and 93°C.
 - .5 Piping
 - .1 Test to requirements of Section 20 05 07, Materials testing.

- .6 Glycol System
 - .1 All tests to be the same as for the hot water system
 - .2 Verify glycol concentration levels
- .7 Chemical Treatment System
 - .1 Acceptance tests by independent lab to provide performance guarantee
- .3 Control System
 - .1 General
 - .1 Provide all necessary assistance and adjustment through control system 7 day performance test.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Provide meters and gauges and taps where shown on drawings and/or specified herein.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Valves and Strainers Section 20 05 23
 - .4 Controls Section 20 30 Series
 - .5 Fire Suppression Division 21
 - .6 Plumbing Division 22
 - .7 Heating, Ventilation and Air Conditioning Division 23

1.3 SUBMITTALS

- .1 Submit shop drawings of proposed products to the Engineer for review. Comply with Section 20 05 05, General Documentation.
- .2 Submit data sheets on thermometers and pressure gauges indicating service, and temperature or pressure ranges, to the engineer for review.
- .3 Submit list of all meters, including location, service, flow and corresponding reading for flow.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Thermometers : Winters, Marsh, Weksler, Terice, Ashcroft, Wika, Unified Valve Group.
- .2 Pressure gauges : Marsh, Terice, Ashcroft, Wika, Weksler, Unified Valve Group.
- .3 Static pressure gauges : Dwyer, Magnehelic

2.2 THERMOMETERS

- .1 Dial Thermometers: 90 mm diameter dial in drawn steel case, bimetallic helix actuated, brass separable socket or flange and bushing, glass cover, adjustable pointer, dual scale, back of bottom connection.

2.3 PRESSURE GAUGES

- .1 100 mm diameter, drawn steel case, phosphor bronze bourdon tube, brass movement, extruded brass socket, 1% midscale accuracy, front calibration adjustment, black figures on white background. Pressure gauges shall be liquid

filled with ½% accuracy in locations subject to vibration (on pumps, air handling units, and chillers), and 1% accuracy in all other locations.

- .2 Provide needle valve and syphon for steam service, pulsating damper and ball valve for water service.

2.4 STATIC PRESSURE GAUGES

- .1 Dial Gauge: 100 mm dial, diaphragm actuated, suitable for positive, negative, or differential pressure measurement. Accuracy within ±2% of full scale, complete with static pressure tips and mounting accessories.

Part 3 Execution

3.1 INSTALLATION

- .1 Provide line size ball valve on all pressure gauges.
- .2 Select all gauges so that normal operating point is approximately mid-point of instrument range.
- .3 On pipes 65 mm and smaller, place well in tee used in lieu of an elbow to accommodate well.
- .4 For pressure gauges at boilers, chillers and heat exchangers where multiple gauges are shown use of a single gauge with pressure piping with ball isolation valves across equipment is an acceptable alternate.

3.2 METERS AND GAUGES INSTALLATION SCHEDULE

- .1 Pressure Gauges
 - .1 Boilers (inlet and outlet)
 - .2 Pumps (inlet, outlet and strainer)
 - .3 Expansion tanks
 - .4 Pressure tanks
 - .5 Upstream and Downstream of propane regulators
 - .6 Leaving side of automatic make-up valves
 - .7 Leaving side of pressure reducing valves
 - .8 and where shown on drawings.
- .2 Thermometers
 - .1 Boiler (inlet and outlet)
 - .2 Supply and return headers of central equipment
 - .3 Heating water zone supply and return mains
 - .4 and where shown on drawings.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Globe or angle valves.
- .2 Check valves.
- .3 Ball Valves
- .4 Butterfly valves.
- .5 Drain valves.
- .6 Hose bibbs.
- .7 Strainers.
- .8 Domestic hot water inline pressure independent balancing valve.
- .9 Circuit balancing valves.
- .10 Pressure independent balancing and control valve (PIBCV).

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Pipe and Pipe Fittings Section 20 20 10
 - .4 Fire Suppression Division 21
 - .5 Plumbing Division 22
 - .6 Heating, Ventilation and Air Conditioning Division 23

1.3 MANUFACTURER

- .1 Provide valves of the same type by the same manufacturer throughout.
- .2 Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.
- .3 All valves shall meet the requirements of the Manufacturers Standardization Society, Standard Practice standards, latest edition. SP-67 Butterfly Valves, SP-70 Cast Iron Gate Valves, SP-71 Cast Iron Check Valves, SP-80 Bronze Gate, Globe, Angle and Check Valves and SP-82 for pressure testing.
- .4 Ball valves to be ULC listed, SP. 110 Standard.

1.4 SHOP DRAWINGS

- .1 Comply with General Mechanical Provisions, Section 20 05 01 and General Documentation, Section 20 05 05.
- .2 Submit detailed shop drawings clearly indicating make, model, size, pressure rating, materials of construction and intended service.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Swing Check Valves : Jenkins, Crane, Toyo, Kitz, Mueller SPX, Moygro, Victaulic.
- .2 Ball Valves : Jenkins, Crane, Toyo, Kitz, MAS, Apollo.
- .3 Butterfly Valves : Keystone, DeZurik, Crane, Jenkins, ITT, Grinnell, Bray, Lunkenheimer, Toyo, Victaulic, Mueller SPX, Apollo, Kitz.
- .4 Drain Valves : Dahl, Crane, Jenkins, Toyo, Kitz, Hammond.
- .5 Hose Bibbs : Dahl, Crane, Jenkins, Toyo, Kitz, Hammond.
- .6 Strainers : Jenkins, Crane, Toyo, Kitz, Victaulic, Mueller SPX.
- .7 Pressure Dependent and Independent Balancing and Balancing and Control Valves : Victaulic, TA, Oventrop, Nexus Valve

2.2 HOT WATER HEATING, GLYCOL SYSTEMS

- .1 Ball Valves:
 - .1 Ball Valves up to 50 mm: Two piece bronze body, full standard port, chrome plated, solid bronze ball, threaded ends or solder ends, TFE seat and packing, lever handle, rating 4134 kPa non-shock W.O.G. rating. Jenkins Figure 910J, Toyo #5044A, Toyo #5049A, Kitz #58, Kitz #59.
 - .2 Ball Valves 65 mm and larger: Floating-ball design providing bi-directional, tight shutoff in accordance with MSS SP-72. The valves shall be rated at 150# WSP/300# WOG. Bodies shall be ductile iron per ASTM A536, With ANSI Class 150 raised-face flanges. The interior and exterior of the body shall be UL certified polyester powder coated to meet NSF/ANSI 61 and NSF/ANSI 372. The ball shall be PFA infused stainless steel, with a stainless steel blowout-proof stem. The seats and body seals shall be PTFE. The stem seal shall be PTFE, externally adjustable chevron type Valves shall be equipped with locking handles as standard and with manual gear operators over 150mm size . Acceptable material: American Valve Model 4000D.
- .2 Swing Check Valves:
 - .1 Swing Check Valves up to 50 mm: Bronze body and disc, regrinding swing check, screw-in cap, threaded ends, rating 860 kPa steam. Jenkins Figure 4092J, Toyo #236, Kitz #22.
 - .2 Swing Check Valves 65 mm and Over (125WOG): Cast iron body, regrind-renew swing check, bolted cover, flanged or grooved ends, bronze disc and seat ring, rating 860 kPa steam. Victaulic #716, Jenkins Figure 587J, Toyo #435, Kitz #76, Moyes & Groves W12A-16V, Centerline Series 800.

- .3 Swing Check Valves 65 mm and Over (250 WOG): ductile iron body, regrind-renew swing check, bolted cover, flanged or grooved ends, bronze disc and seat ring, rating 1035 kPa steam, 1720kPa cold working pressure. Jenkins Figure 587J, Kitz #78, Toyo #435A, Kitz #78, Victaulic #716.
- .3 Silent Check Valve for Pump Discharge:
 - .1 Up to 50 mm: Bronze body, SS stem, 316 SS spring, Teflon disc and seat ring, 430 SS seat screw, threaded ends. 1380 kPa water. Val Matic Series VM-S1400.
 - .2 50 mm and Over: Wafer style, cast iron body, 316 SS seat, plug, spring and bushing. ANSI Class 125. Victaulic #716, Val Matic Series 1400, Moyes Groves W12A-I6A, Centerline Series 800.
- .4 Butterfly valves:
 - .1 Butterfly Valves: Cast iron wafer full-lug body, Stainless steel shaft, bronze disk, replaceable EPDM seat, lever lock handle operator with multiple position lock plate for valve sizes 65 mm to 100 mm, heavy duty gear handwheel operator with position indicator for valve sizes 150 mm and over. Minimum rating 1200 kPa, 121°C. Full rating for end of line or isolation shut off service. DeZurik Fig. 632 R.S., Jenkins Fig 2232ELJ, Apollo #143 CBE, Kitz #6122 EL.
 - .2 Grooved-End Butterfly Valves: Shall be rated to 2070 kPa and be both bi-directional and dead end service capable to full rated pressure. Body material shall be ductile iron with blow out proof stainless steel stems and electroless nickel coated ductile iron seat. Seat material shall be EPDM. Disc shall be offset from the centerline of the stems and shall be connected to the stem without the use of fasteners or pins. Valve ends shall be grooved. Valve shall have an ISO flange mounting for ease of actuation. Operators shall be as specified by choice in valve table. The standard handle valve 50 mm – 150 mm shall include latch lock, infinitely variable and memory stop features, over 150mm with gear operator. Standard of acceptance 50 mm- 600 mm Victaulic 300 MasterSeal
- .5 Drain Valves:
 - .1 Drain Valves up to 50 mm: Forged brass body, brass cap, stem, and ball. Teflon stem seals and Teflon seat. Hose thread end. Working pressure 1725 kPa at 121°C. Dahl 50.430, Jenkins Fig 901CJ, Toyo #5046, Kitz #68AC.
 - .2 Drain Valves 65 mm and Over: Bronze body, bronze ball, threaded ends, twin seal Teflon seats and Viton seals, "O" ring, lever handle, rating 2070 kPa at 121°C water. Jenkins Figure 32BJ.

2.3 CIRCUIT BALANCING VALVES

- .1 DN50 and Smaller Sizes: 2065 kPa, y-pattern, globe type with soldered or threaded ends, non-ferrous Ametal® brass copper alloy body, EPDM o-ring seals. 4-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter. Victaulic / TA Hydronics Series 786 or 787 STAD, Armstrong, Bell & Gossett.

- .2 DN65 and Larger Sizes: 2065 kPa, y-pattern, globe type with flanged or grooved ends, ASTM A536 ductile iron body, all other metal parts of Ametal® brass copper alloy, EPDM O-ring seals. 8, 12 or 16-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter. Victaulic / TA Hydronics Series 788 or 789 STAG, Armstrong, Bell & Gossett.

2.4 STRAINERS

- .1 Size 50 mm and under: Screwed brass or iron body, Y pattern with 0.75 mm stainless steel perforated screen. R-W/Toyo 380 Kitz #15.
- .2 Size 65 mm to 100 mm: Flanged iron body, Y pattern with 1 mm stainless steel perforated screen. R-W/Toyo #381, Kitz #80.
- .3 Size 125 mm and larger: Flanged iron body, Y pattern with 3 mm stainless steel perforated screen.
- .4 Screen free area shall be minimum three times area of inlet pipe.
- .5 Grooved-End Strainers: 300 psi, shall consist of ductile iron body, type 304 stainless steel convoluted (T-Type) or cylindrical Y-Type) removable baskets. Standard of acceptance Victaulic Style 730 (T-type), Style 732 (Y-type).

2.5 VALVE OPERATORS

- .1 Provide suitable hand wheels for gate, globe or angle, radiation and drain valves, and inside hose bibbs.

2.6 PROPANE SYSTEMS

- .1 Ball Valves: CGA approved, -40°C/F, full bore, 50 mm and smaller Toyo #5044A, Kitz #58, MAS B3.

Part 3 Execution

3.1 INSTALLATION

- .1 Install valves with stem upright or horizontal, not inverted.
- .2 Provide latch lock throttling handle on butterfly and ball valves 65mm and over.
- .3 Install valves for shut-off and isolating service, to isolate all equipment, parts of systems, or vertical risers.
- .4 Where butterfly valves are installed, provide threaded lug type valves on flanged systems. Grooved mechanical connections where approved.
- .5 Install circuit balancing valves for throttling service and control device by-pass.
- .6 Use Inline Pressure Independent Balancing Valve in domestic hot water recirculating systems. Circuit balancing valves are to be used at DHW recirculation pump only.
- .7 Provide drain valves at main shut-off valves, low points of piping and apparatus and terminal units.
- .8 Size drain lines and drain valves equal to size of apparatus drain connection.

- .9 For pipe sizes 20 mm and over, minimum drain size to be 20 mm.
- .10 Provide hose thread connection with cap and chain for 20 mm drain valves located in ceiling and public areas.
- .11 Provide male NPT nipples with threaded pipe cap for drain sizes over 20 mm where not piped directly to floor drains.
- .12 Provide valved drain and hose connection off the bottom of all strainers.
- .13 Provide to the owner at project completion, one pressure differential flow meter where circuit balancing valves are specified and installed.
- .14 Install strainer on the inlet to pumps where indicated. Use temporary screens during construction and system cleaning. Remove temporary and install permanent screens prior to system balancing. Refer to Section 23 05 92, Coordination with Balancing Agency.

3.2 CONTROL VALVE FLUSHING

- .1 Where the specified products are used the Balancing & Control Valves Pressure Dependent (BCVPD) and Pressure Independent Balancing and Control Valves (PIBCV) may be installed prior to filling of system.
- .2 Valves shall be set to fully open position and PIBCV diaphragm shall be deactivated prior to flushing through control valve.
- .3 Coil hoses to be looped to bypass coil.
- .4 For alternate manufacturers submit alternate procedures for review by the Consultant.

3.3 APPLICATION

- .1 Provide valves as indicated on the drawings and as outlined in the following schedule:
 - .1 Swing Check Valves
 - .1 Discharge of pumps
 - .2 Spring Loaded Check Valves
 - .1 Pump discharge, vertical installation
 - .3 Drain Valve
 - .1 Near main shut-off valves
 - .2 Low points in piping systems
 - .3 Bases of vertical risers
 - .4 At equipment
 - .4 Butterfly Valves
 - .1 Interchangeable with gate and ball valves in water systems
 - .5 Ball Valves
 - .1 Shut-off and isolation
 - .2 Isolating service
 - .3 Domestic water (hot and cold)

- .4 Drain valves
- .5 Glycol systems
- .6 Circuit Balancing Valves
 - .1 On glycol piping systems for throttling and flow measurement where shown on drawings
 - .2 On control valve bypass.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Pipe hangers and supports.
- .2 Duct hangers and supports.
- .3 Chimney/vent supports.
- .4 Flashing for mechanical equipment.
- .5 Sleeving for mechanical equipment.
- .6 Pipe anchors.
- .7 Access Doors (in walls and ceilings).
- .8 Pipe and duct penetrations through fire rated walls and floors.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 Summary or Work Section 01 11 00
 - .2 Fire Stopping Section 07 84 00
 - .3 General Mechanical Provisions Section 20 05 01
 - .4 General Documentation Section 20 05 05
 - .5 Seismic Restraint Systems Section 20 05 30
 - .6 Heating, Ventilation and Air Conditioning Division 23

1.3 REFERENCE STANDARDS

- .1 Pipe supports shall meet the requirements of ANSI B31.1 Power Piping.
- .2 Duct hangers shall conform to SMACNA Duct Manuals.
- .3 Fire stopping to National Building Code requirements.

1.4 SUBMITTALS

- .1 Comply with requirements of Section 20 05 05, General Documentation and Division 01.
- .2 Submit shop drawings of each factory fabricated component.
- .3 Provide engineered shop drawings for all intermediate and final structural supports. Submit shop drawings designed and stamped by a Professional Engineer regularly engaged in structural system design and registered or licensed in the Yukon Territory. Meet all requirements for Engineered submittals as specified Section 01 33 00 including having in force professional liability insurance with minimum coverage limit of \$1 000 000 per claim and annual aggregate.

1.5 QUALIFICATIONS

- .1 Installation work by competent qualified tradesman only.

Part 2 Products

2.1 UPPER ATTACHMENTS - GENERAL

- .1 Steel joist:
 - .1 Cold piping 50 dia. and under: galvanized steel washer plate with double locking nuts.
- .2 Steel channel, joist or angle (bottom):
 - .1 Malleable iron C clamp to MSS SP-58-1993, type 23, galvanized. ULC listed.
- .3 Steel channel, joist or angle (top):
 - .1 Malleable iron top of beam C clamp to MSS SP-58-1993, type 19, galvanized. ULC listed.
- .4 Wall Hangers:
 - .1 Carbon steel, plain, medium duty suitable for loads to 675kg, suitable for loading from top or bottom, width as required. Complying with MSS-SP-69 (Type 32).
 - .2 Bottom loads: provide carbon steel washer plate, size to suit rod size.
 - .3 Wall Support, Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp.

2.2 PIPE HANGERS AND SUPPORTS

- .1 Hangers, Pipe Sizes 15 mm to 40 mm: adjustable wrought galvanized steel clevis.
- .2 Hangers, Pipe Sizes 50 mm and Over: Adjustable wrought steel clevis or steel clevis.
- .3 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- .4 Vertical Support:
 - .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, ULC listed.
 - .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
 - .3 Bolts: to ASTM A307.
 - .4 Nuts: to ASTM A563.
- .5 Floor Support: Galvanized, pipe floor flange with split ring clamp.
- .6 Design hangers so they cannot become disengaged by movements of supported pipe.
- .7 Provide copper plated hangers and supports for copper piping.
- .8 Provide galvanized hangers and supports for galvanized piping.

2.3 INSULATION PROTECTION SHIELDS AND SADDLES

- .1 Shields: Formed metal insulation shields, carbon steel, galvanized finish, to WW-H-171E(Type 41), minimum length 200mm.
- .2 Saddles: formed carbon steel plate, to WW-H-171E(Type 40A/40B).

2.4 HANGER RODS

- .1 Provide galvanized or cadmium plated rods, threaded both ends, threaded one end, or continuous threaded.

2.5 WALL CLAMPS

- .1 Continuous slot formed hot dipped galvanized channel, 12-14Ga with proprietary mounted fasteners and standard pipe clamps.

2.6 DUCT HANGERS AND SUPPORTS

- .1 As a minimum, conform to Standards in SMACNA.

2.7 FLASHING

- .1 Steel Flashing: 0.5 mm galvanized steel.
- .2 Counter flashings - galvanized sheet steel of 0.8 mm minimum thickness.
- .3 Caps: Steel, 0.8 mm minimum, 1.6 mm at fire resistance structures.

2.8 SLEEVES

- .1 Pipes through Floors: Form with steel pipe sched 10.
- .2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe, schedule 10
- .3 Ducts: Form with galvanized steel.
- .4 Size large enough to allow for movement due to expansion and to provide for continuous insulation and a 13 mm minimum, 25mm maximum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

2.9 ACCESS DOORS

- .1 Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame.
- .2 Rated access doors shall be UL-listed. Refer to Architectural plans for fire rated ceilings and walls.
- .3 Access doors in finished tile locations to be stainless steel.
- .4 Acceptable Manufacturers and Products: Acudor; Miami Carey; Micor; Titus; Controlled Air; Mifab.

- .5 Minimum 300 mm x 300 mm for inspection and hand access. Minimum 600 mm x 600 mm for personnel access.

2.10 FIRE STOPS

- .1 Rated caulking for pipe penetration through fire rated floors and walls:
 - .1 Acceptable Manufacturers: Metacaulk; Spec Seal; Hilti; 3M; Flamesafe.
 - .2 Sealant shall be thioxtrepic, intumescent, non-slump, non-volatile.
 - .3 Firestop material shall provide a 2h rating and be in compliance with ASTM-E814, UL1479, ASTM-E119, UL723, ASTM-E84, UL263 and CAN4-5115.
- .2 Rated fire stop for PVC plastic pipe:
 - .1 Acceptable Manufacturers: 3M; Spec Seal; Hilti; Flamesafe.
 - .2 Intumescent collars, suitable for use on PVC or CPVC pipes penetrating 1h or 2h rated wall or floor, tested to CAN4-S115, UL Listed.

2.11 CONCRETE

- .1 1. Cast-in-place concrete shall comply with CSA A23.1, and be mixed, placed, and cured accordingly.
- .2 Minimum compressive strength shall be 20 MPa at 28 days, exposure class N
- .3 Concrete reinforcement to be to CSA G30.18, Grade 400
- .4 Tie all bars securely in place, and support reinforcement on chairs.
- .5 Epoxy dowels to be installed per manufacturer recommendations, with hole properly prepared and cleaned.

2.12 STEEL

- .1 Provide structural steel to CSA G40.20 or ASTM A992, with a minimum grade of 300W for steel shapes and plates. Bolts and nuts to ASTM A325, F3125, or equivalent.
- .2 Fabricate steel and custom hardware to CSA S16
- .3 Any welding to CSA W59, by welders approved by the Canadian Welding Bureau
- .4 Steel fabricator to provide shop drawings for review prior to fabrication. Design of connections by steel fabricator unless noted otherwise.
- .5 Shop coat steel surfaces for heated interior areas with one coat of primer to CISC/CPMA 1-73A. For all other areas, use one coat of CGSB 1-GP-40 primer.
- .6 Shop coat primed steel surfaces with two coats semi gloss paint finish. Colour to match existing or as directed by Owner.

Part 3 Execution

3.1 GENERAL REQUIREMENTS

- .1 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction.
- .2 Coordinate all hangers and supports with requirements of seismic restraint systems as specified Section 20 05 30 – Seismic Restraint Systems.
- .3 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
- .4 Select hangers and supports for the service and in accordance with manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
- .5 Fasten hangers and supports to building structure or inserts in concrete construction only where specified and approved by the Owner. All other support to be from floor.
- .6 Do not weld piping, ductwork or equipment supports to building metal decking or building structural steel supports.
- .7 Discuss and obtain approval for any hanging systems and methods to the building structure.
- .8 Use of ductwork, piping or equipment for hanger supports and use of perforated band iron, wire or chain as hangers is not permitted.
- .9 Install rubber vibration isolators on piping supports within drywall partitions.

3.2 SLEEVES

- .1 Provide and set sleeves or block-outs required for equipment, including openings required for placing equipment.
- .2 Provide sleeves for all piping through rated assemblies.
- .3 In non-rated assemblies, provide sleeves for all heating, piping through floors, walls and footings except vertical risers concealed in walls. Sleeves to be sized to allow insulation to pass through and to project through both sides of wall or floor and for installation fire proofing.

3.3 INSERTS

- .1 Use epoxy glued inserts or alternate mechanical fasteners where approved by the seismic engineer for securing structural stands to concrete floor.
- .2 Where concrete slabs form finished floor, finish inserts flush with slab surface.
- .3 Use inserts only certified for use in seismic installations and approved by Seismic and Structural engineer.

3.4 PIPE HANGERS AND SUPPORTS

- .1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size mm	Distance Between Supports mm		Hanger Rod Diameter mm
	Steel	Copper	
15 to 20	1800	1500	10
25 to 40	2100	1800	10
50 to 65	3000	2400	10
80 to 100	3600	3000	16

- .2 Install hangers to provide minimum 15 mm clear space between finished covering and adjacent work.
- .3 Use oversize hangers to accommodate pipe insulation thickness. For pipes up to 50 mm use high density rigid pipe insulation at hanger location, with an insulation protection shield. For pipes 65 mm and over use insulation protection saddle.
- .4 Place a hanger within 300 mm of each horizontal elbow.
- .5 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.
- .6 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- .7 Where practical, support riser piping independently of connected horizontal piping.

3.5 DUCT HANGERS AND SUPPORTS

- .1 Support duct work in accordance with SMACNA, and as a minimum as follows.

- .2 Low Pressure Duct Hangers and Supports

.1 Hanger Minimum Sizes:

Up to 750 mm wide: 25 mm x 1.6 mm at 3.0 m spacing;

775 mm to 1200 mm wide: 40 mm x 1.6 mm at 3.0 m spacing;

Over 1200 mm wide: 40 mm x 1.6 mm at 3.4 m spacing.

.2 Horizontal Duct on Wall Supports Minimum Sizes:

Up to 450 mm wide: 40 mm x 1.6 mm or 25 mm x 3 mm at 2.4 m spacing;

475 mm to 1000 mm wide: 40 mm x 40 mm x 3 mm at 1.2 m spacing.

.3 Vertical Duct on Wall Supports Minimum Sizes:

At 3.6 mm spacing;

Up to 600 mm wide: 40 mm x 1.6 mm;

625 mm to 900 mm wide: 25 mm x 25 mm x 3 mm;

925 mm to 1200 mm wide: 30 mm x 30 mm x 3 mm.

.4 Vertical Duct Floor Supports Minimum Sizes:

Riveted or screwed to duct;

Up to 1500 mm wide: 40 mm x 40 mm x 3 mm;

Over 1500 mm wide: 50 mm x 50 mm x 3 mm.

3.6 EQUIPMENT BASES

.1 Provide reinforced concrete housekeeping bases poured directly on existing floor slab, extended 100 mm minimum beyond machinery bedplates for equipment, or as required for seismic restraint anchoring requirements. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

.1 Minimum thickness:

.1 100 mm thick minimum.

.2 Coordinate alternate thickness with SRS requirements.

.2 All new pads to be dowelled into existing slab or similar anchoring system to the existing slab. Coordinate with the seismic engineer. See details.

.3 Provide new bases for the following new equipment:

.1 Heating boiler B-1, B-2 and B-3. Extend base as required to allow for mounting of heat exchanger and tanks

3.7 EQUIPMENT SUPPORTS

.1 Provide anchorage and intermediate and structural supports to support mechanical equipment:

.1 Provide all engineering, design and fabrication of intermediate and final structural steel supports for mechanical equipment and piping to building structural systems.

.2 Engineering design to be designed and sealed by a Professional Engineer regularly engaged in structural and seismic design and registered or licensed in the Yukon Territory.

.3 Review all intermediate and final mechanical support and anchorage with the Owner.

.4 Construct of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure. See Section 20 05 30 – Seismic Restraint Systems for additional seismic requirements

.2 Provide rigid anchors for ducts and pipes immediately after vibration isolation connections to equipment unless spring hangers are specified.

3.8 FLASHING

.1 Flash and counterflash where mechanical equipment passes through waterproofed walls, floors and roofs.

3.9 SLEEVES

- .1 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.
- .2 Piping and duct work passing through floor, ceiling or wall, close off space between duct and sleeve with non-combustible insulation. Caulk both sides.
- .3 Sleeves provided through walls or floors where liquids could potentially pass from one side to the other, provide sleeves with a 25 mm 'flange' welded to the external face of the sleeve at the mid-point of the thickness of the structure to provide a water stop.
- .4 Install chrome plated escutcheons where piping passes through finished surfaces.

3.10 ACCESS DOORS

- .1 Provide access doors for maintenance or adjustment purposes for all new or retrofit mechanical system components.
- .2 Sizes to be 600 mm x 600 mm for body entry, 300 x 300 mm for hand entry.
- .3 Provide UL-listed fire rated access doors installed in rated walls and ceilings.

3.11 INSULATION PROTECTION SHIELDS AND SADDLES

- .1 Type 1: shields and insulation inserts for all new piping where scheduled.
- .2 Definitions: "Exposed" does not include Crawlspace but includes any other spaces typically occupied by the public or building occupants.
- .3 Provide Type 1 shields and Type 2 saddles for all insulated piping as scheduled.

<u>Piping</u>	<u>Type 1</u>	<u>Type 2</u>	<u>Locations</u>
HWS/R	Yes	Yes	All

3.12 FIRE RATED PENETRATIONS

- .1 Install fire stop caulking on pipe penetrations through fire rated floors and walls. Refer to existing building conditions for locations or any rated construction components.
- .2 Install fire stop device on all plastic pipe penetrations through rated walls and ceilings to the National Building Code.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Priority Two (P2) Buildings: buildings in which life safety is paramount concern. It is not necessary that P2 buildings remain operative during or after an earthquake.
- .2 P2 building is a non-post disaster building as defined by the National Building Code of Canada.
- .3 SRS: acronym for Seismic Restraint System.

1.2 GENERAL DESCRIPTION

- .1 Building is classified as a P2 facility. Seismic restraint systems to be provided in accordance with NBCC-Part 4.
- .2 This section covers provision of SRS for all mechanical distribution systems and equipment as follows:
 - .1 Heating boilers.
 - .2 Chimney/Venting
 - .3 Tanks including propane tank
 - .4 Piping and pumps
- .3 Installation of SRS to be fully compatible with and to not affect performance of:
 - .1 Noise and vibration controls specified elsewhere in this project specification.
 - .2 Structural and, mechanical, electrical design of the project.
- .4 The intent of the SRS systems is both life safety and system operation. It is to be the intent of the systems to maintain all equipment in operational state after a significant seismic event. During a seismic event, the SRS is to prevent systems and equipment from failure and/or causing personal injury and from moving from normal position.

1.3 REFERENCES

- .1 CSA G40.21-M92, Structural Quality Steels.
- .2 SMACNA Seismic Restraint Manual-Guidelines for Mechanical Systems.
- .3 National Building Code of Canada.

1.4 SUBMITTALS

- .1 Comply with the requirements of Section 20 05 05, General Documentation.
- .2 Provide for all SRS elements.
- .3 Shop drawings to be prepared by professional firm specializing in the design and supply of SRS systems.
- .4 Submittals to include:
 - .1 Full details of SRS systems for the following elements:
 - .1 Heating boilers.

- .2 Chimney/Venting
- .3 Tanks including propane tank
- .4 Piping and pumps
- .5 Additional items requiring restraint.
- .2 Working drawings of any proposed alternates or deviations from the detailed and specified SRS.
- .3 Details of fasteners and attachments to structure, anchorage loadings, attachment methods.
- .4 Details of installation procedures and instructions.
- .5 Design calculations including restraint systems.
- .6 All submittals to be sealed by a Professional Engineer specializing in design of SRS and registered in the Yukon Territory.
- .7 Provide written identification where the final design will vary from the suggested systems.
- .5 Submit operation and maintenance data for incorporation into manual specified in Section 20 05 05, General Documentation.

1.5 SITE CERTIFICATION

- .1 Site certification for all SRS systems to be provided at no additional cost to the Owner.
- .2 Provide for site certification of installation by Professional Engineer specializing in design of SRS and registered in the Yukon Territory and employed by professional firm specializing in the design and supply of SRS systems.
- .3 Site Certification Inspections are to be provided on the following schedule:
- .4 Substantial completion: Inspection to occur minimum 14 days prior to substantial completion inspection by the Consultant.
- .5 Certifying engineer to provide written and sealed confirmation of installation of systems including detailed list of any deficiencies in a format acceptable to the Consultant.

1.6 DESIGN OF RESTRAINTS

- .1 Detailed design of piping, duct and other mechanical equipment is to be completed by a Professional Engineer specializing in design of SRS and registered in the Yukon Territory.
- .2 Details of restraint systems provided in this specification and the drawings are provided for general configuration only for the recommended systems. Final design of SRS with final sizing of anchors and restraint elements to be provided by and certified by the SRS Design Engineer. Where the final design will vary from the suggested systems advise the Consultant in writing and provide details as indicated in the shop drawing submittals.
- .3 All piping and duct restraint systems to be designed to SMACNA Seismic Restraint
- .4 Manual-Guidelines for Mechanical Systems and ASHRAE RP-812 Guide to Seismic Restraint.

Part 2 Products

2.1 SRS MANUFACTURER

- .1 Where provided SRS to be from one Manufacturer regularly engaged in production of the same.

2.2 MECHANICAL ANCHORS

- .1 Approved SRS type anchors. Minimum 13mm dia.
- .2 Acceptable material: Hilti.

2.3 THREADED ANCHORS

- .1 Minimum Type ASTM A 325-94. Minimum 13mm dia..

2.4 CABLES

- .1 Galvanized, minimum 7x19.
- .2 Approved proprietary adjustment and anchoring systems are acceptable.

Part 3 Execution

3.1 GENERAL

- .1 SRS to provide gentle and steady cushioning action and avoid high impact loads.
- .2 SRS to restrain seismic forces in all directions.
- .3 Fasteners and attachment points to resist same load as seismic restraints.
- .4 SRS utilizing cast iron or other brittle materials not permitted.
- .5 Suspended attachments to concrete floors not acceptable unless approved by Consultant.
- .6 Seismic control measures not to interfere with integrity of firestopping.
- .7 Seismic control measures are not to interfere with vibration isolation systems.

3.2 STATIC EQUIPMENT

- .1 Floor-mounted equipment(General):
 - .1 Anchor equipment to equipment supports at all times using SRS rated fasteners.
 - .2 Anchor equipment supports to structure or housekeeping pad thru manuf. supplied mounts using approved SRS anchors.
 - .3 Provide intermediate structure for anchoring where manuf. supplied mounts not available.
 - .4 Bolts size and locations to manuf. recommendations and SRS design requirements.
- .2 Suspended equipment:
 - .1 Motor driven equipment: Not acceptable.

- .2 All non vibration isolated equipment to be base supported.
- .3 Diffusers:
 - .1 Provide minimum four point suspension with approved wire to bldg structure for each diffuser or rigid connector to structure.

3.3 SLACK CABLE RESTRAINT SYSTEM

- .1 To requirements of SMACNA Seismic Restraint Systems.
- .2 Seismic Hazard Level, forces: as determined by SRS Engineer.
- .3 Connect to suspended equipment so that axial projection of wire passes through centre of gravity of equipment.
- .4 Adjust restraint cables so that they are not visibly slack but permit vibration isolation system to function normally.
 - .1 Tighten cable to reduce slack to 40 mm under thumb pressure. Cable not to support weight during normal operation.

3.4 PIPING SYSTEMS

- .1 All propane gas piping systems to be supported to the requirements of SMACNA Seismic Restraint Manual.
- .2 Seismic Hazard Level, forces: as determined by SRS Engineer.
- .3 All Transverse and Longitudinal bracing to be installed utilizing cable attachments. Use of angle bracing will be acceptable only where approved by Consultant.
- .4 Bracing details apply to all types of piping joints.
- .5 Brace all piping and as specified with the following exceptions:
- .6 Piping is not required to be braced when the piping hanger is less than 300mm in length when measured from the top of the pipe to the bottom of the support where the hanger is attached and the pipe is supported by an individual hanger.
- .7 All piping 50dia and smaller is not required to be braced unless otherwise noted.
- .8 Brace all piping as follows and as noted on drawings whichever is greater:
 - .1 Brace all piping 32dia and larger and all propane gas piping.
 - .2 Provide transverse bracing on maximum 12m centers, longitudinal on 24m centers.
 - .3 Alternate bracing is not acceptable where bracing systems have been designed to incorporate thermal expansion.
 - .4 Use of transverse bracing to provide longitudinal bracing is acceptable where indicated by SMACNA.
 - .5 Seismic bracing for trapeze hangers is acceptable at all locations except where the trapeze hanger may affect the operation of the thermal expansion systems.
 - .6 Bracing of branch piping to brace mains is not acceptable.
 - .7 All piping risers 63dia and greater to be supported at all floor penetrations. Support at top of risers is not an acceptable alternate.

3.5 DUCT SYSTEMS

- .1 All ventilation duct systems and chineies to be supported to the requirements of SMACNA Seismic Restraint Manual.
- .2 Seismic Hazard Level, forces: as determined by SRS Engineer.
- .3 Transverse and Longitudinal bracing to be installed utilizing cable attachments or angle bracing.
- .4 Bracing details apply to all types of duct joints when fabricated to SMACNA or an approved proprietary equivalent.
- .5 Brace all ducts as specified with the following exceptions:
 - .1 Ducts are not required to be braced when the hanger is less than 300mm in length when measured from the top of the duct to the bottom of the support where the hanger is attached and where hangers are positively attached to the duct within 50mm of the top of the duct with a minimum two #10 sheet metal screws and are supported individually.
 - .2 All ducts 700dia and smaller and less than 0.56m² is not required to be braced.
 - .3 All un-braced ducts to be installed a minimum 150mm from all ceiling support wires.
- .6 Brace all ducts as follows:
 - .1 Brace all ducts 700mm dia or 0.56m² and larger. Provide transverse and longitudinal bracing as per SMACNA Seismic Restraint Manual.
 - .2 Use of wall and floor penetrations to provide transverse and longitudinal bracing is acceptable. Block all duct penetrations where the bracing is required.

3.6 INSPECTION

- .1 Do not cover any seismic restraint systems until reviewed by the Consultant and by the Professional Engineer specializing in design of SRS and employed by the professional firm responsible for the design and supply of SRS systems and representative of Authority having jurisdiction unless otherwise authorized.
- .2 In lieu provide photographic verification of installation where approved.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Provide systems to isolate motor driven mechanical equipment as indicated on the drawings and specified herein and guarantee the function of the materials and equipment supplied.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Expansion Compensation Section 20 20 40
 - .4 Seismic Restraint Systems Section 20 05 30
 - .5 Heating, Ventilation and Air Conditioning Division 23

1.3 QUALIFICATIONS

- .1 All vibration isolators and bases shall be supplied by an approved supplier with the exception of isolators which are factory installed and are standard equipment with the machinery.
- .2 Vibration isolators and bases to maintain isolation and not interfere with performance of seismic restraint systems specified Section 20 05 30 – Seismic Restraint Systems.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Vibron, IAC, Mason, Korfund, VAW Systems, Vibro Acoustics

2.2 GENERAL

- .1 All isolation devices for piping systems, equipment and channel frames products by a single vibration isolation manufacturer. Isolation manufacturer's local representative shall maintain an adequate stock of springs and isolators of the type used so that any changes required during construction and testing and startup can be accomplished promptly. Complete installation instructions including details and sizing of anchor devices or plates required shall be furnished by the manufacturer.

2.3 NEOPRENE ISOLATORS

- .1 All neoprene isolators shall be tested to ASTM specifications.
- .2 Where a ribbed pad is used, the height of the ribs shall not exceed 0.7 times the width of the rib. A steel layer shall be used to distribute the load in a multi-layered unit.
- .3 Neoprene pads or elements shall be selected at the manufacturer's optimum recommended loading and shall not be loaded beyond the limit specified in the neoprene manufacturer's literature.

Part 3 Execution

3.1 APPLICATION

- .1 The complete vibration isolation installation shall be in accordance with the manufacturer's recommendations and as specified.
- .2 Provide vibration isolation for mechanical motor driven equipment throughout, unless specifically noted otherwise.
- .3 Deflections 5 mm and under shall use neoprene isolators.
- .4 All equipment mounted on vibration isolators shall have a minimum clearance of 50 mm to other structures, piping, equipment, etc. All isolators shall be adjusted to make equipment level.
- .5 Prior to making piping connections to equipment with operating weights substantially different from installed weights, the equipment shall be blocked up with temporary shims to the final heights. When full load is applied, the isolators shall be adjusted to take up the load just enough to allow shim removal.
- .6 Provide neoprene side snubbers or retaining springs where side torque or thrust may develop.
- .7 Wiring connections to isolated equipment shall be flexible.
- .8 Coordinate all isolation with Seismic Restraint requirements and systems.

3.2 INSPECTION

- .1 Complete after testing and prior to completion.

3.3 PERFORMANCE

- .1 Install isolators of type and deflection as indicated on the Isolation Schedule or according to the following table, whichever provides the greater deflection.

The required static deflection of isolators for equipment exceeding 0.35 kW is indicated below. Spring isolators shall be "open spring". Closed spring isolators shall only be used where specified.

Machine Speed r/min	Slab on Ground Under 15 kW	Structural Slab Over 15 kW	Normal	Critical
Under 400	Special*	Special*	Special*	Special*
400 - 600	25 mm	50 mm	90 mm	Special*
600 - 800	12 mm	25 mm	50 mm	90 mm
800 - 1100	5 mm	12 mm	25 mm	50 mm
1100 - 1500	3 mm	4 mm	5 mm	12 mm

**"Special" indicates as directed by the acoustical consultant.

3.4 SCHEDULE

- .1 Heating Boilers
 - .1 Type 9 neoprene/steel pad isolation between unit base and housekeeping pad.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Identification for mechanical equipment, piping systems and related components.

1.2 RELATED REQUIREMENTS

- .1 Submittals Division 01

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 Painting of Mechanical Work Division 09
 - .2 General Mechanical Provisions Section 20 05 01
 - .3 Pipe and Pipe Fittings Section 20 20 10
 - .4 Piping and Equipment Insulation Section 20 20 30
 - .5 Heating, Ventilation and Air Conditioning Division 23

1.4 QUALITY CONTROL

- .1 Coordinate painting of piping and equipment with work of Division 09.
- .2 Colour code mechanical equipment, piping and exposed ductwork. Refer to label identification schedules.
- .3 Submit a schedule of pipe and equipment identification methods, materials and colours to the Consultant for review.

1.5 REFERENCE STANDARDS

- .1 ASME A13.1 – Scheme for the Identification of Piping Systems.
- .2 CAN/CGSB-24.3 – Identification of Piping Systems.
- .3 Federal Standard 595C Colours.
- .4 WHMIS Pictograms – Workplace Hazardous Materials Information System – GHS (Globally Harmonized System of Classification and Labelling Chemicals) – Pictograms.

Part 2 Products

2.1 IDENTIFICATION LABELS

- .1 Identification Labels for all mechanical piping and ductwork systems, to include:
 - .1 WHMIS Pictogram (as applicable), same colour as legend letters.
 - .2 A lettered legend on a coloured background, defining the contents in the pipe, its pressure and temperature and the information necessary to define the hazard.
 - .3 Arrows to define the direction of flow, same colour as legend letters.
 - .4 50 mm wide black tape at each end of the label, wrapped around the entire circumference of pipe/insulation to secure the Identification Labels.

- .2 Identification Labels may be accomplished by paint, stenciling and/or factory fabricated labels. Labels shall cover full circumference of pipe or insulation.
- .3 Radon exhaust piping: provide hazard identification to municipal or territorial requirements and as specified.

2.2 HEIGHT OF LEGEND LETTERS AND NUMBERS

- .1 Height of Legend Letters and Numbers:

Outside Diameter of Pipe or Covering (mm)	Height of Letters and Numbers (mm)	Length of Colour Field (mm)
19 to 32	13	200
38 to 51	19	200
64 to 150	32	300
200 to 250	64	600
Over 250	89	800

- .2 Lettering and Direction of Flow Arrow:
 - .1 Lettering: Capital, Bold, Sans Serif, Century Gothic or Helvetica.
 - .2 For hazardous piping system: black letters and arrows.
 - .3 Fire protection, other piping systems and ductwork: white letters and arrows, unless otherwise specified.

2.3 VALVE TAGS, DIRECTORIES AND NAMEPLATES

- .1 Valve Tags: 40 mm diameter with 20 mm lettering; brass, lamicoid or metal photo black numbers, secured to valve stem with key chain or plastic tie wraps.
- .2 Valve Directories: laminated sheets and electronic copy. Include the following information for each tagged valve:
 - .1 Valve identifier (valve number or logical point mnemonic).
 - .2 Location.
 - .3 Service.
- .3 Engraved Plastic Nameplates: self-adhesive composite laminated plastic nameplates with one smooth white surface and core of black plastic designed to leave black lettering on a white background. Engraved lettering height as follows:
 - .1 All major equipment: 20 mm
 - .2 Air terminal boxes: 20 mm
 - .3 Magnetic contactors and VFDs: 20 mm
 - .4 All other: 8 mm

Part 3 Execution

3.1 GENERAL

- .1 Identify piping systems and ductwork systems with Identification Labels. Refer to Article 3.2 Identification Schedules.

- .2 Identify the location of the following items of equipment which are concealed above a ceiling with Avery "Data Dots". The colours shall conform to the following schedule:

HVAC equipment and duct cleaning access	yellow
HVAC valves and dampers	blue
Control dampers and sensors	black

When T-bar ceilings are installed, adhere "Data Dots" on T-bar framing adjacent to panel to be removed.

3.2 IDENTIFICATION SCHEDULES

- .1 Colour numbers for Identification Labels on piping systems, valves and equipment are defined in Federal Standard 595C Colours for colour code identification.

Black	17038
Yellow	13591
Green	14193
Orange	12473
Brown	10115
Red	11350
White	17860
Aluminum	16515
Blue	15180
Grey	16293
Light Blue	15450
Purple	17155

- .1 Pipe Identification Label Schedule

Service	Background	Lettering	WHMIS Symbol	Legend
Domestic Cold Water	White	Green	N/A	DOMESTIC COLD WATER
Heating Glycol Supply	Yellow	Black	Yes	HEATING GLYCOL SUPPLY
Heating Glycol Return	Yellow	Black	Yes	HEATING GLYCOL RETURN
Heating Supply	Yellow	Black	Yes	HEATING SUPPLY
Heating Return	Yellow	Black	Yes	HEATING RETURN
Propane	Yellow	Black	Yes	PROPANE

- .2 Ductwork
Identify all concealed and mechanical/fan room ductwork with Identification Labels as follows, complete with directional arrows.
Exception: In suite Apartment and Townhouse ducts do not require identification.

Service	Background Colour	Legend	Lettering
Supply Air	Black	SUPPLY AIR	White
General Exhaust Air	Black	GENERAL EXHAUST AIR	White

- .3 Identify duct access panels with Identification Labels, conforming to the following schedule:

Panel	Background	Lettering
Cleaning and service access	Yellow	Black
Controls, including heat sensors	Black	White
Dampers (backdraft, balance and control)	Blue	White

- .4 Equipment Bases/Housekeeping Pads
.1 Grey, with 100 mm yellow and black angled bands around edges.

3.3 LOCATION OF LABELS

- .1 Orient labels on piping systems in visual sight lines while standing at floor levels.
.2 Locate labels as follows:
.1 Upstream of valves.
.2 Adjacent to changes in direction.
.3 Branches.
.4 Where pipes pass through walls or floors.
.5 On straight pipe runs at 6 m intervals except no more than every 2m for radon exhaust piping.
.6 Where system is installed in pipe chases, ceiling spaces, shafts, or similar confined spaces, at entry and exit points and at access openings.
.7 At beginning and end points of each run and at each piece of equipment.
.3 Adhere labels to piping/insulation or jacket. Labels to cover entire pipe circumference. Secure both ends of labels with 50 mm wide black tape around the entire pipe circumference.

3.4 MECHANICAL CONTROL IDENTIFICATION:

- .1 Refer to Section 20 30 01, Controls and Automation.

3.5 RECORD PROVISIONS

- .1 Mark valve numbers on Red Line system schematic drawings for transfer onto record drawings. Include copies in O & M Manuals.

3.6 VALVE AND THERMOSTAT TAGS

- .1 Tag electric controls, instruments and relays. Key to control schematics on which instruments are numbered in sequence.
- .2 Tag all valves in mechanical rooms.
- .3 Tag all control valves external to mechanical rooms. This includes control valves on radiant panels, perimeter radiation and air terminal boxes.
- .4 Identify and tag thermostats relating to terminal unit and valve numbers.

3.7 VALVE DIRECTORIES

- .1 Include laminated directories in operation and maintenance manuals. Also provide electronic copy in PDF, as well as spreadsheet user editable format.
- .2 Provide the following information on the valve schedule:
 - .1 Valve number
 - .2 Service
 - .3 Equipment that valve is servicing
 - .4 Size
 - .5 Reference drawing number
 - .6 Location of the valve on the drawing, referencing grid line locations

3.8 NAMEPLATES

- .1 Identify the following with engraved plastic nameplates:
 - .1 All mechanical equipment.
 - .2 Electric starting switches, electric disconnects, remote push buttons and control panels.
- .2 All nameplates to be mechanically fastened, easily visible without need to use ladder or extraordinary body position. Affix additional nameplates if necessary.
- .3 Provide for review a schedule and contents of each type of nameplate. Obtain approval prior to engraving.

3.9 BURIED SERVICE PIPING

- .1 Provide detectable buried services identification tape for all piping located outside the building.
 - .1 Exception: not required for foundation drainage systems located at the building structure except where required by the local Authority having jurisdiction.
- .2 Install at depth and with backfill to the requirements of the Civil Divisions.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Expansion tanks.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Plumbing Division 22
 - .4 Heating, Ventilation and Air Conditioning Division 23

1.3 STANDARDS

- .1 Construct pressure tanks to ASME Code for Unfired Pressure Vessels.
- .2 Comply with Provincial Government Regulations.
- .3 NSF/ANSI Standard 61: Drinking Water System Components - Health Effects.

1.4 SUBMITTALS

- .1 Comply with the requirements of Section 20 05 05, General Documentation.

1.5 INSPECTIONS

- .1 Obtain inspection certificates for pressure vessels from Territorial Authorities.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Expansion Tanks Diaphragm : Armstrong, Expanaflex Amtrol Type

2.2 GLYCOL EXPANSION TANKS, DIAPHRAGM TYPE

- .1 Vertical steel pressurized diaphragm type expansion tank.
- .2 Diaphragm: EPDM, renewable suitable for 116 degrees C operating temperature.
- .3 Working pressure: 690kPa.
- .4 Air precharged to 84 kPa (initial fill pressure of system).
- .5 Supports: provide supports with hold down bolts and installation templates incorporating seismic restraint systems.
- .6 Acceptable material: Amtrol Extrol Series
- .7 Schedule: Refer to Drawings

Part 3 Execution

3.1 INSTALLATION - GENERAL

- .1 Provide 100 mm high housekeeping bases for all floor mounted tanks.
- .2 Prime tanks to suit system pressures.
- .3 Provide pressure gauges and isolation at tank connection.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections and Divisions:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Materials Testing Section 20 05 07
 - .4 Valves and Strainers Section 20 05 23
 - .5 Heating, Ventilating and Air Conditioning Division 23

1.2 COORDINATION WITH WORK IN OTHER SECTIONS

- .1 Coordinate piping installation routes and elevations with installation of sheet metal and electrical work.

1.3 QUALITY ASSURANCE

- .1 Non specified pipe joining and pipe fitting methods such as T-drill and Press Fit are not permitted in any piping system covered under Division 20.
- .2 Grooved piping systems: all grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

Part 2 Products

2.1 PIPE

	<u>Service</u>	<u>Material</u>
.1	Hydronic heating to 120°C.	Steel, Schedule 40, ASTM A53, Grade B
.2	Equipment drains and overflows	Schedule 40, galvanized steel, ASTM A120 Type 'L' hard copper, ASTM B88M
.3	Propane piping > 10psig	Sch 80 steel to ASTM A53
.4	Propane, aboveground <10 psig	Steel pipe: Up to NPS 2, to ASTM A53/A53M, screwed Schedule 40, seamless. Paint piping with minimum 1 coat of corrosion resistant primer and 2 coats of yellow paint

<u>Service</u>	<u>Material</u>
.5 Propane, underground <10 psig	<p>Copper tube: Type K, externally coated by factory with extruded yellow polyethylene jacket, to ASTM B88</p> <p>Plastic piping and tubing to CSA B137.4 complete with anodeless riser extending from within 150mm of grade to 300mm above grade</p> <p>Joint pipe according to manufacturer's recommendations. Threading and gluing not permitted on polyethylene pipe.</p> <p>Socket Fittings: to ASTM D2683.</p> <p>Compression Fitted Joints: to ASTM D746 with internal tabular stiffener.</p> <p>Use approved transition fittings when joining polyethylene pipe to other pipe materials.</p>

2.2 FITTINGS & JOINTS

<u>Service</u>	<u>Material</u>	<u>Joint</u>
1. Glycol and hydronic heating to 120°C.	Banded malleable iron, 1035 kPa and 2067 kPa up to 50 mm Steel, same schedule as pipe, for sizes 50 mm and larger	Threaded up to 50 mm Rigid grooved mechanical with angle pattern bolt pad 50 mm and larger
2. Propane	Steel	Malleable iron or steel to ANSI B16.3 and threaded to ANSI B1.20.1, screwed, banded, Class 150 Welding: butt-welding fittings Cast copper fittings: to ASME B16.18 Wrought copper fittings: to ASME B16.22
	Copper	

2.3 UNIONS AND FLANGES

- .1 Size 50 mm and under: 1035 kPa and 2067kPa, malleable iron, bronze to iron ground joint unions for threaded ferrous piping, air tested for gas service, all bronze for copper piping.
- .2 Flange Bolting: For systems up to 120°C, use carbon steel stud bolts, semi-finished, and heavy hex nuts, ASTM A307-GrB. For systems up to 215°C, use alloy steel bolts ASTM A193-GrB7, and semi-finished heavy hex nuts ASTM A194-Gr2H.

2.4 GROOVED COUPLINGS

- .1 Minimum rated pressure: 2410kPa.
- .2 Grooved joint couplings shall consist of two ductile iron housing segments, pressure responsive elastomer gasket, and ASTM A449 zinc-electroplated steel bolts and nuts, sizes: 25mm through 600mm.
- .3 Rigid grooved mechanical couplings shall have an angle bolt pattern design and shall provide system support and hanging requirements in accordance with ASME B31.1. Rigid couplings shall be used in all locations unless otherwise noted.
- .4 Couplings:
 - .1 Victaulic Style 107N rigid couplings to ASTM A-536, installation ready for direct stab installation without field disassembly.
 - .2 Style 750 on reducing couplings

- .3 Installation-ready Style 177 and Style 77 flexible couplings on connections to mechanical equipment
- .4 Style 72 outlet couplings on pipe headers.
- .5 AGS series two-segment couplings with lead-in chamfer on housing key and wide-width FlushSeal gasket. Basis of Design: Victaulic Style W07 (rigid) and Style W77 (flexible).
- .6 Fittings: Victaulic full flow ductile iron fittings with grooved or shouldered ends to ASTM A536 (Ductile Iron); ASTM A53 or A120 factory fabricated steel.
- .7 Gaskets: Pressure responsive type where pressure increases ability to seal; EPDM Grade E with green colour code identification to ASTM D-2000, suitable for -35°C to +120°C operating temperature range. Suitable for use with specified glycol medias for operating range and concentrations.
- .8 Installation-Ready gaskets EPDM Grade EHP for water and glycol service to +120°C.
- .9 Bolts and Nuts: Heat treated carbon steel to ASTM A449 and A183.
- .10 Flanges: ANSI Class 125/150 ductile iron flanges: Victaulic Style 741/W471 to ASTM A183, suitable for opening, engaging grooves and securing in position with a tight fitting lock bolt.

2.5 PROPANE POLYETHYLENE PIPE (PE): BURIED – OUTSIDE BELOW GRADE

- .1 Pipe: to CSA B137.4.
- .2 Fittings: to CSA B137.4.1.
- .3 Diameter as shown on drawings. Grade PE 3406, Series 160.
- .4 Jointing Methods: Joint pipe according to manufacturer's recommendations. Threading and gluing not permitted on polyethylene pipe.
- .5 Socket fittings: to ASTM D2683.
- .6 Butt Fusion.
- .7 Compression fitted joints: to ASTM D746 with internal tubular stiffener.
- .8 Use approved transition fittings when joining polyethylene pipe to other pipe materials.

Part 3 Execution

3.1 PREPARATION

- .1 Ream pipes and tubes. Clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.
- .2 Protect all steel pipes when stored on site from external conditions and ensure protective coating remains intact. If in the opinion of the Consultant, deterioration of the protective coating has instigated corrosion, all rust must be removed down to bare metal and prime coated with red oxide paint.

- .3 Where couplings are installed on existing piping, thoroughly clean pipe grooves and measure grooves for suitability of installation. If grooves are out of spec, confirm, stop work and inform Consultant.

3.2 CONNECTION

- .1 Screw joint for piping up to and including 50 mm. Grooved piping 65 mm and larger, including branch connections. Screw or groove 50 mm piping for liquid systems.
- .2 Welding, brazing and soldering is not acceptable.
- .3 Make screwed joints with full cut standard taper pipe threads with approved Teflon tape or non-toxic joint compound applied to male threads only.
- .4 Make joints for plain end pipe with gasket and clamp type mechanical fastener.
- .5 Use galvanized couplings with galvanized pipe.
- .6 Make connections to equipment, specialty components, and branch mains after isolation valves, with unions or flanges.
- .7 Provide dielectric type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.
- .8 Use plastic isolation spacers for copper pipe installation in metal studs.

3.3 ROUTE AND GRADES

- .1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furring to a minimum.
- .2 Slope water piping 0.2% and provide hose bibb drains at low points.
- .3 Equip low points with 20 mm drain valves and hose connections and caps.
- .4 Make reductions in water with eccentric reducing fittings installed to provide drainage and venting. Top flat for water, bottom flat for steam.

3.4 INSTALLATION

- .1 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.
- .2 Provide clearance for proper installation of insulation and for access to valves, air vents, drains, unions and clearance to combustibles.
- .3 All propane gas piping above grade shall be primed, painted and labeled for its entire length, including exposed indoor and outdoors. Colour numbers shall be 508-102, as identified in the Canadian Government Specification No. 5-GP-1a.

3.5 GROOVED PIPING SYSTEMS

- .1 Use grooved mechanical couplings and mechanical fasteners in accessible locations and where access can be obtained without removal of equipment or

other materials such as ductwork etc. All grooved components shall be of one manufacturer and conform to local code approval. A gauged torque wrench must be used if required by the manufacturer. Use in concealed vertical shafts is not acceptable.

- .2 Use roll grooving tools to groove pipe to manufacturer's specifications. Perform circumference checks on grooved pipe-ends to confirm that depth of groove is within manufacturer's tolerances. Use copper rolls for copper pipe and stainless steel rolls for stainless steel pipe.
- .3 Confirm pipe ends are clean and free from indentations, projections or roll marks from pipe end to groove to ensure proper gasket sealing.
- .4 Confirm that gasket style and grade are suitable for the intended service.
- .5 Lubricate gaskets with a thin coat of lubricant to manufacturers specifications; apply to gasket lips and exterior to ease installation and avoid pinching the gasket.

3.1 BURIED PROPANE PIPING

- .1 Excavation
 - .1 Excavate trenches in accordance with Division 02.
 - .2 In roads, streets, driveways and parking areas, excavate depth of trench to provide 1200 mm of cover over pipe.
 - .3 On private property, in open non-travelled areas, excavate depth of trench to provide min 900 mm of cover over pipe unless otherwise noted.
- .2 Pipe Laying
 - .1 Lay pipe to specified alignment, to within tolerance of 200 mm.
 - .2 Lay polyethylene pipe on undisturbed trench bottom. Backfill around sides and to top of pipe with sand filled material and thoroughly tamp in place.
 - .3 Prevent dirt from entering exposed ends of pipe.
 - .4 In roads, streets, driveways, and parking areas, provide pipe sleeve of diameter 50 mm greater than gas pipe diameter.
 - .5 Lay service line pipe on proper grade to drain from building to propane tanks.
 - .6 Lay gas pipe on properly graded trench bottom to prevent sags and low points in piping.
 - .7 For polyethylene pipe, provide tracer wire to aid in pipe location.
 - .8 Whenever pipe is to be deflected vertically or horizontally, do not exceed amount of deflection recommended by manufacturer in order to maintain satisfactory piping.
 - .9 Ensure minimum of 1000 mm between gas pipe and any underground structure that runs parallel to gas pipe.
 - .10 Ensure minimum of 100 mm between gas pipe and any underground structure that crosses gas pipe

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Heating water and heating glycol systems to 120°C.
- .2 Miscellaneous systems as scheduled.
- .3 Adhesives, tie wires, tapes.
- .4 Recovering.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Valves and Strainers Section 20 05 23
 - .4 Pipe and Pipe Fittings Section 20 20 10
 - .5 Heating, Ventilation and Air Conditioning Division 23

1.3 REFERENCE DOCUMENTS

- .1 National Energy Code for Buildings
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C335 Steady State Heat Transfer Properties of Pipe Insulation
 - .2 ASTM C411 Hot-Surface Performance of High Temperature Thermal Insulation
 - .3 ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulating and Finishing Cement
 - .4 ASTM C547 Mineral Fiber Pipe Insulation
 - .5 ASTM C612 Mineral Fiber Block and Board Thermal Insulation
- .3 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-2007 Energy Standard for Buildings except Low Rise Residential Buildings
- .4 Canadian General Standards Board (CGSB):
 - .1 CGSB 51-GP-52Ma Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation
 - .2 CAN/CGSB-51.53 Poly (Vinyl Chloride) Jacketing Sheet for Insulated Pipes, Vessels and Round Ducts
- .5 Thermal Insulation Association of Canada (TIAC)
 - .1 Mechanical Insulation Best Practices Guide.

- .6 Underwriters Laboratories Canada (ULC)
 - .1 CAN/ULC-S102 Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC-S701 Thermal Insulation, Polystyrene, Boards and Pipe

1.4 PRODUCT OPTIONS AND SUBSTITUTIONS

- .1 Refer to Division 01 for requirements pertaining to product options and substitutions.

1.5 SUBMITTALS

- .1 Product Data
 - .1 Submit manufacturer's product data in accordance with Division 01 and Section 20 05 01, General Mechanical Provisions.
 - .1 When requested, submit product data and test reports indicating that insulation and recovery assemblies meet flame/smoke development ratings and performance requirements.
 - .2 Shop Drawings
 - .1 Submit shop drawings in accordance with Division 01 and Section 20 05 05, General Documentation.
 - .1 For each application submit an insulation schedule to include the following information:
 - .1 Materials
 - .2 "k" value
 - .3 Thickness
 - .4 Density
 - .5 Finish
 - .6 Jacketing
 - .3 Submit information showing installed insulation and membrane products meet the requirements of ASHRAE 90.1-2007.

1.6 DEFINITIONS

- .1 For the purposes of this Section, the following definitions apply:
 - .1 Concealed: piping systems and equipment in trenches, shafts, furring, and suspended ceilings.
 - .2 Exposed: piping systems and equipment in mechanical rooms or otherwise not "concealed".
 - .3 "k" Value: thermal conductivity of insulating material per unit of thickness (W/m.°C).

1.7 FLAME/SMOKE DEVELOPMENT RATINGS

- .1 Pipe insulations, recovery materials, tapes, vapor barrier facings and adhesives shall have maximum flame spread rating of 25 and maximum smoke developed rating of 50, when tested in accordance with CAN/ULC-S102.
- .2 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking or flaming when tested in accordance with ASTM C411.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and store materials in original packaging with manufacturer's labels.
- .2 Protect materials against damage from weather and construction activities.
- .3 Separate waste materials for reuse and recycling in accordance with Division 01.

Part 2 Products

2.1 HOT PIPE INSULATION

- .1 Hot Pipe Insulation (Hydronic, Glycol and Water Systems) - Mineral Fibre:
 - .1 Material: formed rigid mineral fibre insulation sleeving to ASTM C547.
 - .2 "k" Value: maximum 0.035 W/m.°C at 24°C mean temperature.
 - .3 Service Temperature: up to 150°C.
 - .4 Jacket: factory applied general purpose jacket.

2.2 ACCESSORIES

- .1 For mineral fibre insulation materials:
 - .1 FSK Tape: vapor barrier tape consisting of laminated aluminum foil, glass fiber scrim and paper, with pressure sensitive self-adhesive.
 - .2 ASJ Tape: vapor resistant tape consisting of all service jacket material with pressure sensitive self-adhesive.
 - .3 Adhesive: quick setting adhesive for joints and lap sealing.
- .2 Thermal Insulating and Finishing Cement: to ASTM C449 mineral fibre hydraulic setting thermal insulating and finishing cement for use up to 650°C.

2.3 RECOVERY MATERIALS

- .1 PVC: to CAN/CGSB-51.53-95, 9 mm thick for interior use, off-white in color with one-piece premoulded fitting covers.

2.4 INSULATED HANGER INSERTS

- .1 10kg density molded fiberglass, fibers oriented parallel to the direction of pipe to high compressive strength, noncombustible; fully resistant to water, oils, gasoline or common solvents, or, corrosion, odors, insects and oxidation, operating range - 84°C to 232°C.
- .2 Length: 300 mm.

- .3 Acceptable material: Hamfab H Block.

2.5 REMOVABLE PREFABRICATED INSULATED VALVE AND EQUIPMENT ENCLOSURES

- .1 Design: to permit periodic removal and replacement without damage to adjacent insulation, to enclose entire equipment body with minimum 50 mm overlap at mating flanges or overlaps.
- .2 Suitable for insulation of Heat Exchanger HEX-1
- .3 Insulation:
 - .1 Hot systems: BGF needled E Glass Mat, binder free. Minimum thickness or U value as indicated. Thermal Conductivity "k" shall not exceed 0.031 W/m. °C at 24°C mean temperature when tested in accordance with ASTM C 335-95.
 - .2 Cold systems: flexible unicellular, preformed tubular elastomer to CAN/CGSB-51.40-95, thermal conductivity "k" shall not exceed 0.04 W/m. °C at 24°C mean temperature when tested in accordance with ASTM C 335-95, service temperature: -4°C to 100°C.
 - .3 Insulation thickness: to match piping system.
- .4 Jacket & lining: ULC listed fiberglass cloth with Teflon coating.
 - .1 Liner not required for cold systems.
- .5 Fasteners: Velcro type flap along parting edges. Cinch belts and D-rings as required.
- .6 Quilts: 300 SS quilting pins with SS washers.
- .7 ID Tag: printed tags encased in plastic holder.
- .8 Construction: jacket sewn with inside seams formed to fit insulation, insulation secured with quilting pins to jacket.
- .9 Operating range: 0°C to 262°C.
- .10 Acceptable material: Reflex style C8 Insulation Covers.

Part 3 Execution

3.1 INSTALLATION, GENERAL

- .1 Apply insulation after required piping system tests have been completed, witnessed and certified.
- .2 Ensure piping surface is clean and dry before insulating.
- .3 Install in accordance with TIAC National Standards.
- .4 Install in accordance with manufacturers recommendations.
- .5 Ensure insulation is continuous through walls and floor penetrations.
- .6 Locate cover seams in least visible locations.

- .7 Stagger butt joints where multi-layered insulation is used.
- .8 On vertical piping with diameters 25 mm and larger, use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Repeat supports on 4.5 m centers and at each valve and flange.
- .9 Tightly fit insulation sections to pipe to make smooth and even surfaces. Cut insulation for proper fit where weld beads protrude. Bevel away from studs and nuts to allow their removal without damage to insulation. Trim closely and neatly around extending parts of pipe saddles, supports, hangers, clamp guides and seal with insulating/finishing cement.

3.2 HOT PIPE INSULATION APPLICATION

- .1 Apply mineral fibre insulation when pipe surface temperatures are 50°C to 60°C.
- .2 Apply mineral fibre insulation and recovery over full length of pipe without penetration of hangers, interruption at sleeves and fittings. Seal butt joints with 100 mm wide ASJ tape.
- .3 Terminate mineral fibre insulation at each end of unions and flanges. Trowel finishing cement into bevel.
- .4 Fittings: cover with equivalent thickness of tightly placed flexible insulation and apply PVC fitting covers and seal to adjacent insulation jacket.
- .5 Valves:
 - .1 DN 50 and smaller, all locations:
 - .1 Cover with equivalent thickness of tightly placed flexible insulation and apply reinforcing membrane embedded in vapor retardant coating and apply PVC fitting covers.
- .6 Cut mineral fibre insulation layers straight on 10 m centers with 25 mm gap to allow for expansion between terminations. Pack void tightly with insulation and protect joints with aluminum sleeves.
- .7 Recover interior exposed mineral fibre insulated piping with PVC.
- .8 Do not insulate the following piping system components:
 - .1 Unions, flanges, strainers, expansion joints, flexible piping connectors.
 - .2 Chrome plated or stainless steel piping.
 - .3 Valve bonnets on domestic water systems.
 - .4 Drains, plugs and caps.
- .9 Insulation on piping smaller than 40mm and located in partitions and in conditioned spaces insulation may be reduced to a minimum 25mm thickness.

3.3 INSULATION TYPE AND THICKNESS SCHEDULE

Insulation Type and Thickness Schedule		
Service Type and Nominal Pipe Diameter (mm)	Insulation Type	Insulation Thickness (mm)
Heating water and Glycol heating to 90degC:		
35 and smaller	Hot Pipe	40
40 and larger	Hot Pipe	50
Heat Exchanger	Removable pre-fabricated	50

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 All pumps except where integral with a manufactured piece of equipment.
- .2 Pumps controls where self-contained.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Valves and Strainers Section 20 05 23
 - .4 Vibration Isolation Section 20 05 48
 - .5 Expansion Compensation Section 20 20 40
 - .6 Controls Section 20 30 Series
 - .7 Plumbing Division 22
 - .8 Heating, Ventilation and Air Conditioning Division 23
 - .9 Electrical Division 26

1.3 SUBMITTALS

- .1 Submit with shop drawings certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- .2 Dimensional Drawings and product data for manufactured products and assemblies.
- .3 Submit manufacturer's operating maintenance and installation (IOM) instructions.

1.4 QUALITY ASSURANCE

- .1 Ensure pumps operate at specified system fluid operating temperatures and pressures without vapour binding and cavitation, are non-overloading in parallel or individual operation, operate within 25% of midpoint of published maximum efficiency curve. Motor capacity shall be adequately sized to prevent overloading throughout entire range of performance curve.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Wet Rotor : Armstrong, Grundfos, Taco, B&G

2.2 GENERAL

- .1 Statically and dynamically balance rotating parts.
- .2 Construction shall permit complete servicing without breaking piping or motor connections.
- .3 Pumps shall operate at a maximum 1750 rpm unless specified otherwise.

- .4 Pump connections shall be flanged.
- .5 All pump flanges to be complete with pressure gauge tappings.

2.3 WET ROTOR VARIABLE SPEED PUMPS

- .1 Pump shall be of the in-line wet rotor design. Oil lubricated pumps and shaft coupled pumps shall not be accepted.
- .2 The pump shall be a standard product of a single pump manufacturer. The pump, motor, and variable speed drive shall be an integral product designed and built by the same manufacturer.
- .3 The enclosure shall be marked "Enclosure Type 2."
- .4 The pump shall be certified and listed by a Nationally Recognized Test Laboratory (NRTL) for U.S. and Canada to comply with:
 - .1 UL778
 - .2 UL 60730-1A
 - .3 CAN/CSA No. 108
- .5 The pump shall be labeled on the nameplate as having an Energy Efficiency Index (EEI) of no greater than 0.20
- .6 Ratings:
 - .1 Maximum Pressure: 175 PSIG
 - .2 Minimum Media Temperature: 14 °F
 - .3 Maximum Media Temperature 230 °F
 - .4 Maximum Sound Pressure Level: 43dB(A)
 - .5 Voltage: 1x115V +/-10%
 - .6 Maximum Energy Efficiency Index: 0.20
- .7 Construction:
 - .1 Pump housing: Cast Iron: EN-JGL-250 with Cataphoresis surface treatment
Stainless Steel: 304 Stainless
 - .2 Impellers: Composite PES 30% GF
 - .3 Rotor Can: PPS reinforced with Carbon Fiber(Fortran MT9141L PPS-GF40)
 - .4 Rotor Cladding: 316 Stainless Steel
 - .5 Stator Housing: Aluminum
 - .6 Shaft: 316L Stainless Steel
 - .7 Thrust Bearing: Axial: Carbon Graphite, Radial: ceramic Alumina HiloX 961
 - .8 O-Rings: EPDM
 - .9 Bearing Plate: 304 Stainless Steel
 - .10 Neck Ring: 304 Stainless Steel
 - .11 Control Box: Polycarbonate
- .8 Motor

- .1 Motor shall be 4-pole permanent-magnet (PM motor) and tested with the pump as one unit by the same manufacturer. Conventional asynchronous squirrel-cage motors shall not be acceptable.
- .2 Each motor shall be of the integrated Variable Speed Drive design consisting of a motor and a Variable Frequency Drive (VFD) built and tested as one unit by the same manufacturer.
- .3 The stator housing shall be made of pressure die cast aluminum.
- .4 The motor shall be cooled by the pumped fluid
- .5 The power electronics shall be cooled to the ambient air.
- .6 The Motor shall be self-ventilating.
- .7 Minimum insulation class for the motor shall be Class F.
- .8 The integrated VFD control shall utilize an energy optimization algorithm to minimize energy consumption by reducing the factory-set setpoint and adjust to system characteristics. This shall be accomplished without the need of any external sensors or input.
- .9 Operating Modes
 - .1 The pump shall have the following control mode and operating modes:
 - .1 AUTOADAPT – During operation, the pump automatically reduces the factory-set setpoint and adjusts it to the actual system characteristic. Manual setting of the setpoint is not possible.
 - .2 FLOWLIMIT - It shall be possible for the user to select a maximum flow that the pump shall not exceed in order to eliminate the need for additional throttling valves. The pump shall operate per selected control mode but will limit speed to not exceed the user specified flow limit
 - .3 FLOWADAPT – The pump shall operate in the AUTOADAPT control mode with FLOWLIMIT enabled.
 - .4 Proportional Pressure – The head delivered shall be reduced from a manual setpoint linearly in accordance with decrease in flow demand in the system
 - .5 Constant Pressure – A manual set, constant head is maintained, irrespective of flow up to the maximum speed of the pump.
 - .6 Constant Curve – The pump runs as an uncontrolled pump by the means of a set of pump curves. The pump curve adjustable between maximum and minimum from the control panel or through a wireless remote control.
 - .7 Constant Temperature – the pump shall adjust speed to maintain a constant media temperature in the flow pipe in which the pump is installed.
 - .8 Constant Differential Temperature - the pump shall adjust speed to maintain a constant temperature drop between the flow pipe in which the pump is installed and a user installed temperature sensor.
 - .9 Alternating Operation – Two single head pumps or two heads of a dual head pump shall communicate wirelessly to one another. In alternating operation, only one pump shall operating at a time. The

- operation shall alternate based on time or energy to ensure even run time of both pumps. If a pump stops due to fault the other pump shall take over automatically.
- .10 Back-Up Operation – Two single head pumps or two heads of a dual head pump shall communicate wirelessly to one another. In Back-Up operation one pump shall operate continuously. If the duty pumps stops due to fault the back-up pump shall take over automatically.
 - .11 Cascade Operation - Two single head pumps or two heads of a dual head pump shall communicate wirelessly to one another. Two pumps shall operate together in constant pressure control. The pump controller shall determine when to operate a single pump or both pumps to meet demands. While both pumps operate they shall run at the same speed.
- .10 Interface and Communication
- .1 The pump shall have an integrated operator interface consisting of:
 - .1 Minimum 2.4" (measured diagonally) color TFT display
 - .2 7 push buttons for navigation of menu
 - .3 Push Buttons must be able to operate at minimum 25,000 times
 - .4 Push Buttons must be isolated from the main supply by reinforced insulation according to UL60730
 - .5 LEDs to signal pump status for quick indication
 - .2 The pump shall have a sensor integrated directly into the pump housing with 4 lines consisting of Ground, Supply, and two signals for Differential Pressure and Media Temperature.
 - .1 Sensor Supply shall be 4.8V DC +/- 2% at 20mA referenced to Ground. The supply must be able to withstand a permanent short circuit.
 - .2 The electrical values for the signal shall be 4.8V DC +/-2% referenced to ground.
 - .3 The pump module shall have one analog input configurable for either 4-20mA or 0-10VDC input signal configurable for external Temperature or Pressure sensor, or Setpoint influence. Sensor input shall have three wires for Ground, Supply, and Signal. The Supply for external analog input shall be 24V DC +/-10% at 22mA reference to Ground. The supply must be able to withstand a permanent short circuit. Connection can be made to a screw terminal capable of wire sizes up to AWG16.
 - .4 The pump shall have 3 Digital Inputs galvanically isolated from the main supply by a reinforced insulation according to UL60730.
 - .1 Start/Stop –Used to start or start the pump. The pump shall be enabled when connected to common ground by an external potential free short circuit. An open circuit to this input shall disable the pump. Connection can be made to a screw terminal capable of wire sizes up to AWG16.
 - .2 Minimum – used to force the pump to run at minimum load (curve). When connected to common ground by an external potential free

- short circuit the pump must run at minimum load. Connection can be made to a screw terminal capable of wire sizes up to AWG16.
- .3 Maximum - used to force the pump to run at maximum load (curve). When connected to common ground by an external potential free short circuit the pump must run at maximum load. Connection can be made to a screw terminal capable of wire sizes up to AWG16.
 - .5 The pump module shall have two Output Relays. Each relay shall be configurable for Alarm, Reading, or Operating indication. Each relay must have three screw terminals see above. Output relays contacts shall be rated for maximum 250VAC at 2A and minimum 5VDC at 20mA. Each must have galvanic isolation from the internal supply by reinforced insulation according to UL60730.
 - .6 Shall be capable of accepting an add-on module for integration into Building Management Systems:
 - .1 Bacnet
 - .7 The pump module shall have wireless connectivity for two pumps to communicate with one another or for the pump to communicate to a mobile device with additional hardware.
 - .8 Communication range shall at minimum within 30ft of the pump without walls or barriers.
 - .9 Two identical pumps shall be capable of wireless communication with one another to operate as a two pump system in:
 - .1 Duty/Standby
 - .2 Alternating Mode, pumps alternate operation every 24 hours
 - .3 Cascade operation with both pumps running simultaneously in constant differential pressure mode.
 - .11 Factory Testing
 - .1 The pumps shall be factory performance and hydrostatic tested as a complete unit prior to shipment. The testing shall be done in accordance with ISO 9906 Annex A. No test certificate is required.
 - .12 Warranty
 - .1 The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture. Warranty shall cover pump, motor and terminal box as a complete unit.
 - .13 Acceptable material: Grundfos Magna 3 Wet Rotor Circulator
 - .14 Schedule: Refer to Drawings

Part 3 Execution

3.1 INSTALLATION

- .1 Do work in accordance with CAN/CSA-B214.
- .1 Provide drains for bases piped to and discharging into floor drains.

- .2 Provide air cock and drain connection. Install volute venting pet cock in accessible location.
- .3 Install pressure gauge isolation ball valves and pressure gauges.
- .4 Where triple duty (check/isolation and balance) valves on discharge of pumps, provide additional isolation valve downstream of triple duty valve.
- .5 Decrease from suction line size with eccentric reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Support suction guide and discharge elbow from a floor stand with rubber and shear sandwich pad isolators or from above with hangers and spring isolators.
- .6 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges. Install with bearing lubrication points accessible.
- .7 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

3.2 STARTUP

- .1 Pre-Startup
 - .1 Drain casing and bleed all air from volute and ensure pump full primed.
 - .2 Verify pump is level.
 - .3 Check nameplate is readily visible.
- .2 Startup
 - .1 Startup as recommended by manufacturer.
 - .2 Check rotation.
 - .3 Run in pump for minimum 12hrs continuous operation.
 - .4 Ensure flow through parallel pumps is equally balanced.
 - .5 Verify seal performance.
 - .6 Clean strainers.
 - .7 Replace shaft seals if pump has been used to degrease system.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 This Section specifies general requirements for on-site cleaning and chemical treatment of mechanical systems.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
- | | | |
|----|---|------------------|
| .1 | General Mechanical Provisions | Section 20 05 01 |
| .2 | General Documentation | Section 20 05 05 |
| .3 | Cleaning and Chemical Treatment Equipment | Section 20 21 01 |
| .4 | Cleaning and Chemical Treatment of Glycol Systems | Section 20 21 05 |

1.3 REFERENCE DOCUMENTS

- .1 American Society for Testing and Materials (ASTM):
- | | | |
|----|------------|--|
| .1 | ASTM D1192 | Equipment for Sampling Water and Steam in Closed Conduits. (withdrawn) |
| .2 | ASTM D2688 | Standard Test Methods for Corrosivity of Water in the Absence of Heat Transfer (Weight Loss Methods) |

1.4 SUBMITTALS

- .1 Comply with requirements of Section 20 05 01, General Mechanical Provisions.
- .2 Submit the following information and documents for approval by the Consultant:
- | | |
|----|---|
| .1 | Proposed cleaning procedure. |
| .2 | Material and safety data sheets for chemical treatment, cleaning products, corrosion inhibitor, water test reagents, and glycol. |
| .3 | A permit from the appropriate regulatory body to dispose of spent cleaning solutions to sanitary sewer system, or a statement of intention to dispose of spent cleaning solutions at an approved off-site location. |
| .4 | Recommended control limits and control charts. |
| .5 | Submit additional information specified in related sections. |
| .6 | Submit confirmation of system fill volumes on all hydronic closed loop systems. |

1.5 QUALITY ASSURANCE

- .1 Use a qualified water treatment specialist, who has a demonstrated record of expertise in water systems cleaning and chemical treatment, to supply chemicals, equipment, and consulting services including testing for the cleaning and chemical treatment work specified.

- .2 All work on site work to be completed by the mechanical Contractor. The water treatment specialist is not required to complete the site works but is to provide detailed procedures and all testing.
- .3 Acceptable water treatment specialists include:
 - .1 IPAC/DuBois

1.6 INSTRUCTION

- .1 Provide operation and maintenance instructions for water treatment systems including following:
 - .1 Chemical requirements for water treatment.
 - .2 Water test procedures.
 - .3 Operation and maintenance of water treatment equipment.

1.7 SEQUENCING

- .1 Perform cleaning and chemical treatment activities as one continuous process without interruption.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 DISPOSAL OF SPENT CLEANING SOLUTION

- .1 Chemical treatment agency shall provide directive and assistance to the mechanical contractor in the degreasing, cleaning and chemical treatment of all piping systems.
- .2 Dispose of spent cleaning solution in an environmentally responsible manner. Following methods are acceptable:
 - .1 Disposal through local sanitary trucked system if regulatory body will accept spent cleaning solutions and issue a disposal permit.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 This Section specifies equipment which needs to be installed as part of mechanical systems to permit chemical cleaning, chemical treatment and monitoring to be performed.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
- | | | |
|----|--|------------------|
| .1 | General Mechanical Provisions | Section 20 05 01 |
| .2 | General Documentation | Section 20 05 05 |
| .3 | Systems Demonstration and Owner's Instruction | Section 20 05 06 |
| .4 | Chemical Treatment and Cleaning - General Requirements | Section 20 21 00 |
| .5 | Cleaning and Chemical Treatment of Glycol Systems | Section 20 21 05 |

1.3 REFERENCE DOCUMENTS

- .1 American Society for Testing and Materials (ASTM):
- | | | |
|----|------------|--|
| .1 | ASTM D1192 | Equipment for Sampling Water and Steam in Closed Conduits. (withdrawn standard) |
| .2 | ASTM D2688 | Standard Test Methods for Corrosivity of Water in the Absence of Heat Transfer (Weight Loss Methods) |

1.4 PRODUCT DATA

- .1 Comply with requirements of Division 01.
- .2 Provide product data for each piece of equipment and control systems. Include sizes and capacity for each system.

Part 2 Products

2.1 TREATMENT EQUIPMENT (GENERAL)

- .1 Chemical Pot Feeder: capable of operating at system working temperature and pressure.
- .2 By-pass Filters: constructed of stainless steel, sized to handle 5% of system circulating rate, and capable of operating at system working temperature and pressure; 5 micron cartridges.
- .3 Flow Indicators: constructed of bronze and glass, with ball, sized to handle 5% of system circulation rate, and capable of operating at system working temperature and pressure.

2.2 GLYCOL FILL SYSTEMS

- .1 General : feeder compatible with glycol solutions of up to 60% concentration, unit to be completely assembled.
- .2 System shall include 64 litre storage/mixing tank with cover; pump suction hose with inlet strainer; pressure pump with thermal cut-out; integral pressure switch; integral check valve; cord and plug; pre-charged accumulator tank with EPDM diaphragm; manual diverter valve for purging air and agitating contents of storage tank; pressure regulating valve adjustable (35 – 380 KPa) complete with pressure gauge; built-in check valve; union connection; 12 mm x 900 mm long flexible connection hose with check valve; low level pump cut-out. Pressure pump shall be capable of running dry without damage.
- .3 Power supply 115/60/1 0.7 A.
- .4 Unit shall be completely pre-assembled and certified by a recognized testing agency to CSA standard C22.2 No 68.

Part 3 Execution

3.1 EQUIPMENT INSTALLATION

- .1 Install chemical pot feeder as shown on drawings. Provide one for each glycol system.
- .2 Install by-pass filter as shown on drawings. Do not install filter cartridge until system has been cleaned. Provide at a minimum one bypass filter for each closed loop hydronic and glycol system.

3.2 GLYCOL CHARGING TANK

- .1 Provide one glycol charging tank for each glycol system unless otherwise noted.

3.3 CHEMICAL TREATMENT AND CLEANING EQUIPMENT SCHEDULE

- .1 Supply and install chemical treatment and cleaning equipment for systems as follows:

System	Equipment
Glycol Systems Section 20 21 05	Chemical Feed Pot Bypass Filter Bypass Filter Cartridge Flow Indicator Glycol Fill System

END OF SECTION

Part 1 General

1.1 INTENT

- .1 This Section specifies services and material required for onsite cleaning and chemical treatment of new work on existing multi-metal, closed loop glycol heating system.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
- | | | |
|----|---------------------------------------|------------------|
| .1 | General Mechanical Provisions | Section 20 05 01 |
| .2 | General Documentation | Section 20 05 05 |
| .3 | Systems Demonstration and Instruction | Section 20 05 06 |

1.3 REFERENCE DOCUMENTS

- .1 American Society for Testing and Materials (ASTM):
- | | | |
|----|------------|---|
| .1 | ASTM D1121 | Standard Test Method for Reserve Alkalinity of Engine Coolants and Anti-rusts |
| .2 | ASTM D2688 | Standard Test Method for Corrosivity of Water in the Absence of Heat Transfer (Weight Loss Methods) |

1.4 PERFORMANCE REQUIREMENTS

- .1 Cleaning activities shall remove oil, grease, silt, and rust from system. Cleaned metal surfaces shall be well passivated.
- .2 Ensure that chemical treatment is capable of maintaining operation performance standards as follows:

Parameter	Control Limits
Suspended Solids	Nil
Iron Corrosion Rate	Stable Rate, 0.5 mils per year maximum, no pitting
Copper Corrosion Rate	Stable Rate, 0.2 mils per year maximum, no pitting
Total Iron Concentration	0.5 mg/L Fe maximum
Total Copper Concentration	0.2 mg/L Cu maximum

1.5 SUBMITTALS

- .1 Submit a written report of actual cleaning activities including:
- | | |
|----|-----------------------|
| .1 | Times. |
| .2 | System status. |
| .3 | Problems encountered. |
| .4 | Actions taken. |

- .5 Composition of cleaning & spent cleaning solutions.
- .6 Type of glycol or manufacturer's brand name of glycol added to system, if required.
- .7 Inspection results.
- .8 Final glycol concentration.
- .9 Final pH level.
- .10 Final reserve alkalinity based on 100% glycol.
- .11 Final suspended solids concentration.
- .12 Final iron concentration.
- .13 Corrosion coupon weights.
- .14 Corrosion rates.
- .15 Final Iron and Copper concentration.

Part 2 Products

2.1 GENERAL

- .1 All chemicals specified in this section are to be non-toxic when release to atmosphere, non-corrosive and non-staining is a leak occurs.
- .2 All chemical to be approved by owner and authority for release into sewer system
- .3 For each treatment system for which chemicals are supplied, supply and hand over to the Owner at substantial, spare chemical in original container. Quantity to be sufficient for two months of treatment of system.
- .4 The only acceptable supplier of the chemical feed equipment and treatment specified in this section is IPAC/DuBois

2.2 POT FEEDER

- .1 All closed loop hot water systems to be provided with a bypass chemical pot feeder with a 7.6L capacity. It shall be constructed of heavy duty cast iron or welded steel rated to 200psi with quick opening cap and complete with NPT $\frac{3}{4}$ with isolating valves installed on inlet outlet and drain.
- .2 Acceptable Products; SAI

2.3 CHEMICAL FEED PIPING

- .1 Schedule 40 black steel.

2.4 SIDESTREAM FILTER

- .1 All closed loop hot water systems to be provided with a sidestream filter housing of steel construction using 250mm x 5 micron filter cartridge with a minimum flow rate of 35 lpm, complete with sightglass, NPT $\frac{3}{4}$ connection and isolation valves.
- .2 Provide six additional spare filters.
- .3 Acceptable Products: Axiom SFP-10

2.5 HEATING FLUID

- .1 Closed System – Boiler Loop and hot water loop.
 - .1 Charge system with treated water
- .2 Closed System – Glycol
 - .1 Charge Secondary Glycol Supply Loop with DOWFROST HD Only. Minimum 50/50 factory pre-mix.
 - .2 Contractor to leave spare barrel with Owner, in mechanical room if possible.

2.6 CHEMICALS

- .1 System Cleaner:
 - .1 Liquid form alkaline type cleaner consisting of a concentrated blend of highly active penetrating agents and detergents with a 14pH and specifically formulated to remove oil, mill scale and oxides from piping and equipment.
 - .2 Acceptable Products: IPAC/Dubois
- .2 Closed Heat System Treatment:
 - .1 Chemicals, chemical feed equipment and test equipment to be control corrosion in closed heat transfer circulating systems as indicated on the drawings and as specified.
 - .2 Treatment to be chromate free, nitrite/borate type corrosion inhibitor suitable for use with both ferrous and non-ferrous metals.
 - .3 Provide inhibitor test kit.
 - .4 Acceptable Products: IPAC/Dubois
- .3 Boil-out
 - .1 Boil-Out chemicals to be selected by treatment manufacturer and boiler supplier.
 - .2 Provide alkalinity, Sulphide and PH test kit

2.7 TEST EQUIPMENT

- .1 Provide one set of test equipment for each system to verify performance.
- .2 Complete with carrying case, reagents for chemicals, specialized or supplementary equipment.

Part 3 Execution

3.1 CLEANING - GENERAL

- .1 Maintain isolation from existing systems until cleaning completed and approved.
- .2 Maintain following conditions during cleaning process:
 - .1 Manual and automatic valves are in full open position.
 - .2 By-pass valves are operated to ensure full flow through cleaned system.

- .3 Safety devices, including pressure relief valves, flow switches, and pressure switches are functioning.
- .4 System is operated with a minimum pressure of 35 kPa(g) at highest point.

3.2 CLEANING PROCEDURE

- .1 Provide copy of recommended cleaning procedures and chemicals for approval by Consultant.
- .2 Flush mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials. Use chemicals to inhibit corrosion of various system materials that are safe to handle and use.
- .3 Examine and clean filters and screens, periodically during circulation of cleaning solution, and monitor changes in pressure drop across equipment.
- .4 Drain and flush system[s] until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .5 Disposal of cleaning solutions approved by authority having jurisdiction.

3.3 CHEMICAL TREATMENT - CONTROL LIMITS

- .1 Control limits are to be per specified by heating fluid and treatment chemical manufacturer
- .2 Air system heating & preheat coils are defined as "Not Exposed to Outside Temperatures".

3.4 TESTING

- .1 Test for limits of existing system prior to connection to new work and 48hrs after connection.
- .2 All testing at approved laboratory. Provide results for approval.
- .3 Test glycol samples for following:
 - .1 Visual appearance.
 - .2 pH level.
 - .3 Glycol concentration.
 - .4 Reserve alkalinity concentration based on 100% glycol.
 - .5 Suspended solids concentration.
 - .6 Iron and copper concentration.
- .2 Document glycol analyses results on a chemical treatment report form.
- .4 Document glycol analyses results and any adjustments to the system on a chemical treatment report form.

3.5 WASTEWATER DISPOSAL

- .1 Wastewater discharged into a municipal sanitary sewer system from existing or new systems shall be within the limits established by local authorities.
- .2 Dispose of spent cleaning solution in an environmentally responsible manner.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Balance, adjust, test air, liquid and equipment systems, and submit reports using identical units to those shown on contract documents.
- .2 Obtain sound level readings and submit reports for scheduled rooms within the building.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Plumbing Division 22
 - .4 Heating, Ventilation and Air Conditioning Division 23

1.3 QUALITY ASSURANCE

- .1 Work specified in this section shall be performed by an Independent Agency specializing in this type of work.
- .2 Balancing (of both air and liquid systems) and sound level readings shall be performed by the same agency.
- .3 Balancing procedures shall be in accordance with
 - .1 SMACNA
 - .2 ASHRAE Standards; and
 - .3 AABC National Standard for Total System Balance 7th Edition.

1.4 SYSTEM REVIEW

- .1 Prior to the TAB contractor executing their work, and within 2 months of the award of the mechanical contract, the TAB contractor shall complete systems review of all systems in the TAB scope of work. The review shall be of the Construction Documents and Specifications and include in scope a review of the suitability of systems for TAB including locations, sizes and types of valves, dampers and other equipment and size and distribution flows and pressures of HVAC equipment.
- .2 A written report is to be submitted to the Engineer for review.
- .3 The report shall include full reporting of the systems review and include recommendations on any additional dampers or valves required for proper balancing.
- .4 The report shall be forwarded in writing to be reviewed by the Engineer.

1.5 TIMING

- .1 Begin balancing after equipment start-up and testing, and after systems have been completed and are in full working order. Place systems and equipment into full operation, and continue operation during each working day of balancing.

1.6 BALANCING AGENDA

- .1 General: Submit balancing agenda to the Engineer for review at least sixty (60) days prior to the start of balancing work. Start balancing work only after agenda has been approved. Include descriptive data, procedure data and sample forms in agenda.
- .2 Descriptive Data: General description of each system including associated equipment and different operation cycles, listing of flow and terminal measurements to be performed and selection points for proposed sound measurements.
- .3 Procedure Data: Procedures for converting test measurements to establish compliance with requirements, specify type of instrument to be used, method of instrument application (by sketch) and correction factors.
- .4 Sample Forms: Form showing application of procedures to typical systems.

1.7 BALANCE REPORT

- .1 Submit a draft outline for the balancing report (less field data) 60 days after award of contract. The report is to include all information available (i.e., fan curves and pump curves with design data plotted, distribution drawings, technical data, design and shop drawings, descriptive data, etc.). The Contractor will be able to invoice 5% of the contract value after the report is reviewed and accepted by the consultants.
- .2 Provide a PDF database and four (4) copies of final reports to the contractor for inserting in the Owner's Operating and Maintenance Manuals as described in Section 20 05 05, General Documentation.
- .3 Include types, serial number and dates of calibration of instruments in the reports.

1.8 SYSTEM DATA

- .1 Pumps including existing main circulators.
 - .1 Design Data
 - .1 Fluid flow rate
 - .2 Total head
 - .3 r/min
 - .4 kW, r/min, amps, volts, phase
 - .2 Installation Data
 - .1 Manufacturer and model
 - .2 Size
 - .3 Type drive
 - .4 Motor type, kW, r/m, voltage, phase, and full load amperage
 - .3 Recorded Data
 - .1 Discharge and suction pressures with secondary systems on both bypass and full circulation (full flow and no flow)
 - .2 Operating head

- .3 Operating water flow rate (from pump curves if metering not provided)
- .4 Motor operating amps (full flow and no flow)
- .5 r/min
- .2 Heating Boilers
 - .1 Design Data
 - .1 Heat transfer rate
 - .2 Fluid flow rate
 - .3 Entering and leaving fluid temperatures
 - .4 Fluid pressure drop
 - .2 Installation Data
 - .1 Manufacturer, model, type
 - .2 Entering and leaving fluid temperatures
 - .3 Capacity
 - .4 Pressure drops
 - .5 Flow rates
 - .3 Recorded Data
 - .1 Element type and identification (location and designation)
 - .2 Entering and leaving fluid temperature (for varying outdoor temperatures)
 - .3 Fluid pressure drop
 - .4 Fluid flow rate
 - .5 Pressure relief valve setting
- .3 Heat Exchangers
 - .1 Design Data
 - .1 Fluid flow rates (heated media, heating media)
 - .2 Fluid type
 - .3 Inlet and outlet temperatures
 - .2 Installation Data
 - .1 Manufacturer, model, type
 - .2 Fluid flow rates (heated media and heating media)
 - .3 Inlet and outlet temperatures
 - .4 Pressure relief valve setting
 - .3 Recorded Data
 - .1 Heating media entering flow rate
 - .2 Heated media leaving flow rate
 - .3 Entering and leaving temperatures (for varying outdoor temperatures) and pressures
- .4 Expansion Tank
 - .1 Design Data

- .1 Size
 - .2 Capacity
 - .3 Pressure rating
 - .4 Installation data
 - .5 Manufacturer, size, capacity
 - .6 Pressure reducing valve setting
 - .7 Pressure relief valve setting
- .5 Sound Level Data
- .1 Diagram or description of relationship of sound source and measuring instrument
 - .2 scale reading
 - .3 Graph readings at each octave band frequency
 - .4 Calculate room N.C. levels

Part 2 Products

2.1 INSTRUMENTS

- .1 Provide calibration histories for each instrument. Recalibration or use of other instruments may be requested when accuracy of readings is questionable.

Part 3 Execution

3.1 GENERAL PROCEDURE

- .1 Permanently mark, by stick-on labels and/or fluorescent paint, settings on valves, splitters, dampers, and other adjustment devices.
- .2 Subsequent to correctional work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.
- .3 Where vane anemometer is used to measure supply, return or exhaust air grilles, AK factors shall be determined as follows:
 - .1 Determine and tabulate similar sized grilles being balanced for AK schedule.
 - .2 Traverse all ducts serving grilles (outlined in AK schedule) to verify AK factors.
 - .3 AK factor from schedule, must be approved by Engineer during initial review with balancer on site. (Balancer shall include written procedure for determination of AK factors.)
 - .4 No-flow hoods are to be used for measurement of exhaust or return air grilles.
- .4 Balancing shall be performed to the following accuracies:
 - .1 Air - terminal outlets $\pm 10\%$ (outlets less than 200 L/s)
 - .2 Air - terminal outlets $\pm 5\%$ (outlets greater than 200 L/s)
 - .3 Air - central equipment $\pm 5\%$
 - .4 Hydronic - pumps and central $\pm 5\%$

- .5 Balancing contractor shall advise mechanical contractor of required revised pulleys, sheaves and impeller shavings to allow proper balancing of systems (Refer to Section 23 05 92, Coordination with Balancing Agency.)
- .6 Where axial fans require blade pitch changes, this shall be the responsibility of the balancing contractor.
- .7 Where pump impellers require shaving, this shall be the responsibility of the mechanical contractor. All adjustments shall be by qualified millwright. All changes shall be documented and included as part of the balancing report.

3.2 BALANCING OF HYDRONIC SYSTEMS

- .1 Open all (except pressure bypass must be closed) valves to fully open position including balancing valves, isolation valves and control valves.
- .2 Remove temporary strainers and install permanent sheaves prior to commencing balancing of hydronic systems
- .3 Set pumps to deliver rated flow or 10% greater if possible. For parallel pump systems set pumps in parallel operating condition.
- .4 Force all existing control valve to open through BAS OWS
- .5 Set pump operating differentials to operate to meet highest circuit differential and return all circuits to operation and verify proportional flow achieved in all circuits at circuit main balancing valves.
- .6 Adjust loads using BAS terminal unit control by selectively closing the minimum quantity of heating valves evenly between circuits and verify operation of pump differential pressure control and flow delivery to the zones with highest pressure differential flow for each to each circuit while all circuits operating in parallel (reduce overall load throughout the building and ensure highest demand zones are satisfied). Record total flows on each circuit, number of zones and locations closed to verify system diversity.
- .7 Position and mark all manual (pressure dependent) flow balancing valves for design flow through all coils, connectors, and all items in system requiring circulation of liquid.
- .8 Upon completion of flow readings, mark setting and record data.
- .9 For all parallel pumping systems, check all flows under the following situations:
 - .1 With two pumps operating
 - .2 With one pump operating - repeat for each pump
 - .3 With controls demanding no heating
- .10 For each pump, plot maximum and minimum flows on curve.
- .11 Coordinate final hydronic balance set points and differential pressure requirements with the BAS Contractor to allow update to BAS operating set points.

3.3 REPORT

- .1 Submit draft copies of rough balancing reports prior to final acceptance of project.
- .2 Include types, serial number and dates of calibration of instruments.
- .3 Record test data on a database from the latest available revised set of mechanical drawings and submit three (3) copies upon completion of the balancing contract for inclusion in equipment and maintenance manuals.
- .4 Submit with report, fan and pump curves with operating conditions plotted. Submit grille and diffuser shop drawings and diffusion factors. Submit report in an electronic database.
- .5 Report shall be indexed as follows:
 - Air
 - Summary
 - Procedure
 - Instrumentation
 - Drawings
 - Equipment Summary
 - Liquid
 - Summary
 - Procedure
 - Pump Data
 - Pump Curves
 - Circuit Balancing Settings

END OF SECTION

Part 1 General

1.1 DESCRIPTION OF SYSTEMS

- .1 Provide complete integrated operating system of controls for systems indicated herein and the mechanical drawings. The system is to use electronic and electromechanical controllers, except where digital based controllers are integrated into manufacturer supplied equipment.

1.2 SCOPE

- .1 Provide a complete system of automatic controls for the building systems referred to in this specification.
- .2 Provide all engineering, materials and services as documented within these specifications and as required to furnish a complete and fully operational control system to monitor and control the building systems referred to in this specification.
- .3 The work includes the supply and installation of electronic and electromechanical controllers, instrumentation, control devices, conduit, wiring and other devices as necessary to provide a complete system of automatic controls, compliant with these specifications. The contractor shall be responsible for the detailed engineering, installation, supervision and labour services, calibration, and commissioning necessary for a complete and fully operational system as specified. Adjustment and calibration shall be provided as a prerequisite
- .4 Include:
 - .1 Submittals,
 - .2 System Documentation,
 - .3 Acceptance Testing, and
 - .4 Instructions to Owners as identified within these specifications.

1.3 RELATED WORK

- .1 General Provisions For Controls Section 20 30 03
- .2 Sequence of Operations Section 20 30 93.1

1.4 WORK BY OTHERS

- .1 Installation of control valves shall be by the mechanical contractor.
- .2 Installation of control dampers shall be by the mechanical contractor.

1.5 SUBMITTALS

- .1 Within 90 days of contract award submit detailed shop drawings.
- .2 Within 120 days of contract award:
 - .1 Draft O& M Manuals as specified in this section under system documentation.

- .3 Prior to Acceptance Test:
 - .1 A signed declaration stating that all work has been completed or identifying any outstanding deficiencies and the anticipated completion date(s).
 - .2 A complete set of manufacturers operations manuals for all software provided as part of this project.
 - .3 All "System Documentation" as specified in this section.
 - .4 Record drawings.

1.6 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 20 05 01, General Mechanical Provisions, and with the requirements outlined below.
- .2 Shop drawings are to be submitted in an organized fashion complete with table of contents, tab sheets and sequentially numbered pages to enable easy location of information. This also applies to component data sheets.
- .3 Submit two (2) copies of the complete shop drawings to the consultant for review and approval. Partial submissions will not be accepted. Submit three (3) additional copies of the complete approved shop drawings with the O&M Manuals.
- .4 Provide sufficient detail to enable the consultant to evaluate the proposed system and to determine whether the requirements of the specification will be met.
 - .1 Specification sheets for each item. To include manufacturer's descriptive literature, specification, drawings, diagrams, performance and characteristic curves, catalog cuts, manufacturer's name, trade name, catalog or model number, nameplate data, size, layout, dimensions, capacity, all other data to establish compliance.
 - .2 General logic diagrams and description.
 - .3 Controller locations.
 - .4 Panel layouts.
 - .5 Control cabinet locations.
 - .6 Schematic single line diagrams showing cable routing's, conduit sizes, field controllers and systems being controlled, panel layouts.
 - .7 Dampers: schedule listing operator locations, damper sizes, spring return. Engineering/technical data and maintenance information for each system component, including sizing and arrangements as requested. Include calculations for control valve selections.
 - .8 Wiring diagrams.
 - .9 Piping diagrams and hook-ups.
 - .10 Shop drawings for each piece of equipment including:
 - .1 Sensing element type and location.
 - .2 Transmitter type and range.
 - .11 Associated field wiring schematics, schedules and terminations.
 - .12 Manufacturer's recommended installation instructions and procedures.

1.7 DEMONSTRATION AND OWNER'S INSTRUCTION

- .1 Formal training sessions shall commence only after Operations and Maintenance Manuals drawings have been completed, reviewed and approved by the Consultant and shall supplement to Section 20 05 06, Systems Demonstration and Owner's Instruction, requirements.
- .2 Approved Operations and Maintenance Manuals shall be made available during all training in both hard and digital formats.
- .3 Meet all requirements of Section 20 05 06, Systems Demonstration and Owner's Instruction.
- .4 Training to be completed by the Site Technician plus additional individuals who have had specific training as an instructor shall conduct training sessions.
- .5 All training sessions shall include training materials and shall follow a documented course outline.
- .6 A copy of the training materials, which shall include a training outline shall be submitted to the Consultant for approval three weeks prior to commencing any training sessions.
- .7 Any training conducted without prior approval of the Consultant shall be repeated at the discretion of the Consultant and/or will not count toward the contractor's training obligations.
- .8 The Contractor shall provide three weeks written notice to the Consultant and building Owner prior to commencing formal training sessions.
- .9 One day shall constitute a minimum 6 hours of training, not including time of lunch and additional breaks.
- .10 Provide for training according to the following schedule.
 - .1 A 3h4 system and component familiarization training during the 7-day acceptance test covering all aspects of system use as follows:
 - .1 Operation of hardware components.
 - .2 User/system interaction.
 - .3 Calibration of sensors and system.
 - .4 Trouble shooting of system and components.
 - .5 Preventative maintenance.
 - .6 Alarm management.
 - .2 One, 2hr session within 1 month of warranty to the following agenda:
 - .1 Review all previous training.
 - .2 Review new updates.
 - .3 Review operations during warranty.
- .11 All costs for training excluding wages of the building operators shall be covered by the vendor.
- .12 Owner representation:
 - .1 The Owners team attending the training will be comprised of a maximum of one operator and one manager.

1.8 WARRANTY

- .1 Provide a one year warranty on all items provided under this contract including but not limited to all equipment, wiring and systems. The warranty period shall commence on the date of substantial acceptance.
- .2 Provide on-site service including all labor, materials to maintain the complete control system in optimal functioning condition, provided regular maintenance is performed by the Owner.
- .3 Regular maintenance of the BAS during the warranty period will be completed by the Owner.
- .4 Response time:
 - .1 On site response from time of call out to response to be 24 hours.
- .5 Response time: where a response time of 24 hours cannot be achieved by the BAS vendor, remote support is to be provided during the Warranty period.
- .6 In addition to warranty callbacks provide two service inspections of a minimum eight of hours duration each. These calls will be initiated by the Owner.
- .7 Maintain a service log on site of all control system maintenance activities during the warranty period.

1.9 SYSTEM ACTIVATION

- .1 Verify that each hardware component has been properly installed as recommended by the manufacturer and is functioning correctly.
- .2 Calibrate all devices including sensors, transmitters, transducers, current relays, valve actuators, damper motors, positioners, etceteras, verifying that end to end calibration accuracy as specified has been achieved.
- .3 Ensure tight shut off and fail safe operation of valves and dampers. Hysteresis shall not be greater than 5% of the operating range.
- .4 Set damper linkages, static pressure/volume controls as required.

1.10 ACCEPTANCE TESTING

- .1 A final operational acceptance test shall be conducted on the complete and total installed and operational control system to demonstrate that it is functioning properly in accordance with the specifications. The acceptance test run times shall be a minimum 7 days.
- .2 The correct operation of all systems shall be demonstrated as well as the operation and capabilities of all sequences, specialized control programs and all hardware Specific testing shall include but not be limited to:
 - .1 Power Failure Restart.
 - .2 Ventilation Reset Schedules
 - .3 Heating and Cooling Reset Schedules
- .3 In the event of the failure of function, during the test, of any of the hardware components or routines, the test will recommence and run until a minimum of an

additional seven failure-free test days added to the original test days have occurred.

- .4 After successful completion of the acceptance test, the Consultant will issue written acceptance of the control system.

1.11 OPERATING AND MAINTENANCE MANUALS

- .1 Comply with Section 20 05 05, General Documentation.
- .2 Building Control Operation and Maintenance Manuals to be incorporated into the building mechanical manuals.
- .3 The Building Control Operation and Maintenance literature shall contain technical data, technician manuals, operational, product data, cleaning and maintenance information on all products and equipment supplied as part of this project.
- .4 Introduction
 - .1 Provide a written explanation of the layout of the manual.
 - .2 List all other control system manuals submitted for this project including all hardware manuals. Identify the quantities of each manual provided.
- .5 Control System Design
 - .1 Design Intent
 - .1 Explain, in this section, the design intent and give a system overview which outlines the relationships between the hardware, operating system, control software and other control components.
 - .2 Provide a detailed description of all parts, components and software in the system.
 - .3 Describe the system architecture. Provide a system configuration schematic with the location, type and model of all control panels, work stations, remote access modems etceteras and identify the major equipment monitored and controlled by each panel.
 - .2 Operations
 - .1 Provide an overview of the building automation system operations. Include basic instruction on:
 - .1 system access
 - .2 alarms management (including, how and where alarms are annunciated, after-hours reporting of critical alarms, etc.)
 - .3 basic trouble shooting directions.
 - .2 These instructions are to provide a basic understanding of the system operations and are to reference specific areas of the hardware manuals for further detailed instructions.
- .6 Building System Descriptions
 - .1 System Design intent - Explain, in this section, the design intent and give a system overview which outlines the system components and the intended system function.
 - .2 Provide a schematic, control sequences, wiring diagram, device list.

- .3 Control sequences shall identify start-up and shut-down sequences, control loop set-points, reset schedules, system interlocks etceteras.
 - .4 As built record drawings in 11" X 17" format, folded to fit into the O&M binders may be used to provide part or all of the information required for this section.
 - .7 Panel Layout**
 - .1 Provide as-built panel layout sheets and include locations of all panels.
 - .2 Include a panel points list that identifies each point name with concise English description and termination point. Identify panel spare points.
 - .3 Identify power source for each panel including emergency/normal, UPS, panel number and circuit number.
 - .8 Shop Drawings**
 - .1 Insert in this section all approved shop drawings organized in the format specified in Section 20 30 01.09, General Provisions for Controls.
 - .9 Equipment Schedules**
 - .1 Provide an equipment schedule for all hardware provided including valves, dampers, actuators, controllers, transducers, input/output devices and other instrumentation.
 - .10 Certification and Testing**
 - .1 Provide final copies of all completed calibration and verification check sheets including all airflow station calibration check sheets.
 - .11 Product Manuals**
 - .1 Include in this manual or within product, user manuals and technical manuals, complete and detailed instruction on the use, setup and support of all control system hardware provided under this project.
 - .12 Maintenance**
 - .1 Provide a description in this section of maintenance procedures for all equipment and systems, as defined in this specification, including a schedule for recommended planned and preventative maintenance work items and intervals.
 - .2 Provide a list of resources to call upon for maintenance and servicing of equipment which includes name, address and phone numbers for supplier and service contact for each piece of equipment.
 - .3 Include in this section a complete set of as-built drawings if not included elsewhere in this manual.
 - .4 Certification, guarantee, warranty.
 - .13 Additional manuals:**
 - .1 Include all technician manuals.
 - .2 General manuals required for trouble shooting.
- 1.12 RECORD DRAWINGS**
- .1 To requirements of Section 20 05 05, General Documentation.

1.13 SPARE PARTS

- .1 To requirements of Section 20 05 05, General Documentation.
- .2 Provide the following spare parts:
 - .1 One room thermostats.
 - .2 Two damper motors.
 - .3 Six control relays of common relay types.
 - .4 Special tools to replace components where tools are not commercially available.
- .3 Turn all spare parts over to Owner in original manufacturers packaging. Provide completed spare parts list and obtain signature from AHS representative of receipt of spare parts.

1.14 QUALIFICATIONS AND APPROVED CONTRACTORS

- .1 Qualifications:
 - .1 Control equipment supply and system design shall be the be developed by one qualified contractor using specified manufacturers unless otherwise specified.
 - .2 Installation of controls to be by qualified controls installation firm. All work is to be performed by personnel under the direct supervision of this firm.
 - .3 Controls contractor to have prior local and regional knowledge in the installation and maintenance of electro-mechanical control systems. The contractor to have offices staffed by trained personnel capable of the design and installation of the specified systems.

Part 2 Products

2.1 GENERAL

- .1 Provide control system components consisting of thermostats, control valves, dampers, actuators, , indicating devices, and interface equipment required to operate mechanical equipment and perform functions specified.
- .2 Provide all materials and labour required to connect control components.
- .3 No splicing or extending of wiring will be accepted.
- .4 Maintain integrity of all fire protection and smoke evacuation systems.

2.2 CONTROL PANELS

- .1 Mount controllers in control panels and field interface equipment (i.e. relays, transducers, etc.) in separate field interface control panels.
- .2 Control panels are to be of unitized cabinet type construction, fabricated from 2.5 mm rolled sheet metal sheet with baked enamel finish, flush fitting, gasketed doors hung on piano type hinges and three point latches and locking handles. CSA approved for line voltage applications.
- .3 Mount pilot lights, push buttons and switches flush on cabinet panel face.

- .4 Mount panels on vibration free walls or free standing angle iron supports. Provide engraved plastic nameplates for instruments and controls inside cabinet and on cabinet face.
- .5 Provide pans and rails for mounting terminal blocks, relays, wiring and other necessary devices.
- .6 Provide an individual switch for disconnection and a fuse for isolation of all panel mounted instruments requiring a 120 volt supply.
- .7 Make all wiring connections in the shop from the equipment mounted on the panel to numbered terminal blocks conveniently located in the panel, including the power supply for all instruments.
- .8 Identify all wiring by means of stamped markings on heat shrinkable tubing that is permanently fastened to wiring. Install all wiring neatly and laced or bunched into cable form using plastic wire clips, where practical, contained in plastic wiring channels with covers. Maximum 25 conductors to each wire bundle.
- .9 Identify all control panels using lamacoid labelling mechanically affixed to panel.
- .10 Provide for input and output sheets to be attached to the inside of the panel doors.
- .11 Provide terminal blocks, tabular clamp, 300 V, complete with track. Each terminal shall be clearly indelibly marked with the wire number connection to it. Each field connecting conductor shall be served by one terminal. Provide 20% spare unit terminals, with a minimum of two spare terminals. Provide all necessary terminal block accessories such as manufacturer jumpers and marking tape.
- .12 Where "Hand-Off-Auto" selector switches are specified system to be such that safety controls and electrical over current protection are not overridden when selector switch is in the "Hand" position. "Hand-Off-Auto" selector switches to the motor equipment and variable speed controller schedules.
- .13 Control Power for control panel shall be 120 Volts A.C. from panel circuits provided by Division 26. All power to be through the emergency power distribution.
- .14 Install bonding conductor between main control and auxiliary panels complete with grounding lugs, in addition to CSA grounding requirements.
- .15 When fabrication of first panel is completed arrange for inspection and approval by Consultant before proceeding with further panel construction.
- .16 All panels in occupied spaces are to be suitable for fully recessed mounting with flush face in occupied space.

2.3 WIRE

- .1 Control wiring for digital functions shall be 20 AWG minimum with 300 Volt insulation.
- .2 Control wiring for analog functions shall be 20 AWG minimum with 300 Volts insulation, twisted and shielded, 2 or 3 wire to match analog function hardware.

- .3 Sensor wiring shall be 20 AWG minimum twisted and shielded, 2 or 3 wire to match analog function hardware or 16 AWG as required by code.
- .4 Transformer current wiring shall be 16 AWG minimum.
- .5 Identify all wiring and cabling by means of stamped markings on heat shrinkable tubing that is permanently fastened to wiring.

2.4 CONDUITS AND CABLES

- .1 All wiring shall be in steel conduit or trays. Flexible conduit may be used for final connection of control devices. Maximum length of flexible conduit to be 1 m. Conform to Division 26 requirements for conduit and trays specifications.
- .2 Seal conduit where such conduit leaves heated areas and enters unheated area.
- .3 In the field panel, run low level signal lines in separate conduit from high level signal and power transmission lines.
- .4 Identify each cable and wire at every termination point by means of stamped markings on heat shrinkable tubing that is permanently fastened to wiring.
- .5 Provide instrumentation complete with standard electrical conduit box for termination unless otherwise noted.
- .6 Separate conduits shall be provided for pneumatic tubing and electrical wiring runs.
- .7 Color code all conductors and conduits by permanently applied color bands. Color code shall follow base building schedule.
- .8 All wiring for terminal equipment controllers including network communications, sensors and actuator wiring must be in conduit or cable tray.

2.5 RELATED ACCESSORIES

- .1 Provide and install all necessary transducers, interposing relays, interface devices, contactors, starters and EP's to perform control functions required.
- .2 It is the responsibility of the Contractor to identify, within 30 days of award, all additional items not specified that are required to meet the operational intent specified.
- .3 Items required but not identified at the time of close of tender shall be the Contractor's responsibility.

2.6 TRANSFORMERS & RELAYS AND CONTACTS

- .1 CSA approved.

2.7 IDENTIFICATION

- .1 Provide all cabinets, and main equipment with nameplate or nameplate tag to requirements of Section 20 05 53 and as follows:
 - .1 Permanently attached to the component
 - .2 Black and white lamacoid plastic with 8 mm bold lettering
 - .3 Include the following:

- .1 Panel descriptor, ID, clear text descriptor.
- .2 Provide and install plastic credit card type nameplates for all discrete items of equipment supplied including but not limited to:
 - .1 Sensors
 - .2 transmitters
 - .3 output devices
 - .4 controllers
 - .5 valves
 - .6 terminal air boxes

Include descriptor and ID, clear text descriptor.
- .3 Provide self-adhesive lamicoid labels, attached to operating equipment under control as directed by the Consultant. Labels have white letters on red background stating:

WARNING

This equipment operates under remote control and may start at any time.
Phone for instructions before operating.
- .4 Submit sample for approval.

Part 3 Execution

3.1 INSTALLATION

- .1 Install all components in accordance with the latest regulations of the Canadian Electrical Code, applicable Municipal and Territorial Codes and Regulations, and latest CSA Electrical Bulletins
- .2 Verify location of thermostats and other exposed control sensors with drawings before installation. Locate thermostats 1500 mm above floor. 1200mm for accessible suites.
- .3 Outdoor air sensors: installation location shall be verified to not be affected by sun load. For multiple units provide programing to select units not affected by the sun load based on time of day.
- .4 Install damper motors on outside of ducts. Do not locate in outside air stream.
- .5 Wire "hand/off/auto" selector switches such that only automatic operating controls and not safety controls and electrical over current protection shall be overridden when switch is in the "hand" position.
- .6 Fans that are to be sequenced with intake or discharge dampers through a single output point, shall be wired such that operation of damper end switch alone will not start fan. I.E. The end switch and DDC "ON" command must both be required to start the fan when the "hand/off/auto" selector switch is in the auto position.
- .7 Unless specified otherwise, install all outdoor air sensors on the north exposure of the building. Locate where they will not be affected by sun load. Provide suitable shielding. Coordinate installation location with Consultant.

- .8 Install all safety limits at the operators level.
- .9 Safety devices including but not limited to fan pressure switches and damper end switches shall be hardwired to trip fan starters on alarm condition.
- .10 Install pressure gauges on branch lines and actuator excepting individual room thermostats.
- .11 Control System Power
 - .1 Provide power to all control system components as necessary to provide continued monitoring and control.
 - .2 Control systems may be powered from a common circuit provided that:
 - .1 Circuit loading does not exceed 900 VA,
 - .2 A minimum of one circuit per air system is provided for the terminal equipment controllers associated with the air system, and
 - .3 Terminal equipment controllers for different air systems are not powered from the same circuit.
 - .3 Power for all transducers and other instrumentation associated with a controller shall come from the same circuit that is feeding the digital controller.
 - .4 Identify in the record drawings and in the control panel the panel and circuit number serving each controller.

FOR THE PURPOSE OF THIS CLAUSE, AN AIR SYSTEM CONSISTS OF AIR HANDLING UNIT(S) PRESSURIZING COMMON DUCTWORK.

3.1 SEQUENCE OF OPERATIONS

.1 HEATING SYSTEM: PRIMARY LOOP HOT WATER CONTROL

- .5 The primary hot water system consists of a single propane fired boiler, equipped with boiler pumps and installed on the primary circulating loop. The primary loop is circulated from the dedicated boiler pumps which transfer heat to the secondary loop. The intent of this boiler is to be a backup source of heat, should the district energy system be disabled.
 - .1 Confirm temperature setpoints from district energy system prior to finalizing boiler operations.
- .6 The heating boiler is to be controlled by standalone networked PLC sequencing controllers.
- .7 On demand for heat as determined by the boiler controller, the pump for the boiler is energized. Once set point is reached the boiler will be disabled. After the boiler is shut down, the respective boiler pump will remain energized until the 1 min post purge cycle is completed.

- .8 Integral boiler controls and safeties (HTL & LWCO) override control signals. Provide alarm points for boiler failure, pump failures, and low or high temperature.

- .9 Provide manual override toggle for boiler enable at control panel. Coordinate with Div 26.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes requirements for selective demolition and removal of heating, ventilation and air conditioning systems, controls and automated automation components, and related mechanical components and incidentals required to complete work described in this Section [ready for new construction] .

1.2 RELATED REQUIREMENTS

- | | | |
|----|--|------------------|
| .1 | Procurement and Contracting Requirements | Division 00 |
| .2 | General Requirements | Division 01 |
| .3 | General Mechanical Provisions | Section 20 05 01 |
| .4 | Equipment Supplied by Others | Section 20 05 02 |
| .5 | Selective Demolition for Plumbing | Section 22 05 05 |

1.3 REFERENCE STANDARDS

- .1 CSA Group (CSA)
- .1 CSA S350 M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

1.4 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes , cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Salvage: Detach items from existing construction and deliver them to [Representative] [Owner] ready for reuse.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide the following in accordance with Section 01 33 00 – Submittal Procedures before starting work of this Section:

1.6 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.
- .2 Scheduling: Account for Owner's continued occupancy requirements during selective demolition with and schedule staged occupancy and worksite activities as a defined Critical Path item in accordance with Section 01 32 16– Construction Progress Schedule .

1.7 SITE CONDITIONS

- .1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition on date that tender is accepted.
- .2 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in the Work; immediately notify [Consultant] [Representative] if materials suspected of containing hazardous substances are encountered and perform the following activities:
 - .1 Hazardous substances will be as defined in the Hazardous Products Act.
 - .2 Stop work in the area of the suspected hazardous substances.
 - .3 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
 - .4 Hazardous substances will be removed by Owner under a separate contract or as a change to the Work.
 - .5 Proceed only after written instructions have been received from Owner.

Part 2 Products

2.1 REPAIR MATERIAL

- .1 General Patching and Repair Materials: Refer Div 2 for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.
- .2 HVAC Repair Materials: Use only new materials required for completion or repair matching materials damaged during performance of work of this Section; new materials are required to meet assembly or system characteristics as existing systems indicated to remain and carry CSA approval labels required by the Authority Having Jurisdiction.
- .3 Firestopping Repair Materials: Use firestopping materials compatible with existing firestopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

2.2 (SALVAGE AND) DEBRIS MATERIALS

- .1 Material Ownership: Demolished materials become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain Owner's property .
- .2 Salvaged Materials: Carefully remove materials designated for salvage and store in a manner to prevent damage or devaluation of materials in accordance with Section 02 42 00.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Existing Conditions: Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid; Owner will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
 - .2 Notify Owner and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
 - .3 Prevent debris from blocking drainage inlets.
 - .4 Protect mechanical systems that must remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Owner and users is minimized and as follows:
 - .1 Prevent debris from endangering the safe access to and egress from occupied buildings.
 - .2 Notify Owner and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.3 EXECUTION

- .1 Demolition: Coordinate requirements of this Section with information contained in Div. 2 and as follows:
 - .1 Disconnect and cap gas supply and electrical services in accordance with requirements of local Authority Having Jurisdiction.

- .2 Do not disrupt active or energized utilities without approval of the Owner.
- .3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.
- .4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.
- .5 At end of each day's work, leave worksite in safe condition.
- .6 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.

3.4 CLOSEOUT ACTIVITIES

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction in accordance with Section 02 42 00.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Prepare the facility for balancing.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 Starting and Adjusting Equipment Prior to Balancing Division 01
 - .2 General Mechanical Provisions Section 20 05 01
 - .3 Documentation for HVAC Systems Section 23 05 05

Part 2 Products

Not Applicable

Part 3 Execution

3.1 INSTALLATION

- .1 Bring the work to an operating state and ready for balancing, including:
 - .1 Clean equipment and ductwork.
 - .2 Install air terminal devices.
 - .3 Provide temporary filters in air handling equipment and carry out a rough air balance to ensure all equipment performs required function.
 - .4 Replace filters with specified filters prior to final balancing.
 - .5 Verify lubrication of equipment.
 - .6 Install permanent instrumentation.
 - .7 Complete the "start-up" of equipment.
 - .8 Review packing and seals on all applicable pumps and on all valves.
 - .9 Check rotation and alignment of rotating equipment and tension of belted drives.
 - .10 Set control points of automatic apparatus, check-out sequence of operation.
 - .11 Make available control diagrams and sequence of operation.
 - .12 Clean work, remove temporary tags, stickers, and coverings.
 - .13 Make available one (1) copy of Maintenance Manuals especially for use in balancing.
 - .14 Provide Balancing Agency a complete set of mechanical drawings and specifications.
- .2 Cooperate with the Balancing Agency as follows:
 - .1 Make corrections as required by Balancing Agency.
 - .2 Allow Balancing Agency free access to site during construction phase. Inform Balancing Agency of any major changes made to systems during construction and provide a complete set of record drawings for their use.

- .3 Provide and install any additional balancing valves, dampers, and other materials requested by the balancing agency and/or necessary to properly adjust or correct the systems to design flows.
- .4 Provide and install revised pulleys and sheaves for rotating equipment without variable speed drives, as required to properly balance the systems to design flows. Obtain requirements from balancing agency (Refer to Section 23 05 93, Testing, Adjusting and Balancing for HVAC Systems).
- .5 Assist operation of the automatic control system and verify set points during Balancing.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 All piping and valving inside building extending to and connecting to gas fired appliances and outlets.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Systems Demonstrations and Owner's Instructions Section 20 05 06
 - .4 Materials Testing Section 20 05 07
 - .5 Equipment Testing and Startup Section 20 05 08
 - .6 Valves and Strainers Section 20 05 23
 - .7 Supports, Anchors, Seals, Pipe and Duct Penetrations, and Access Doors Section 20 05 29
 - .8 Identification for Mechanical Systems Section 20 05 53
 - .9 Pipe and Pipe Fittings Section 20 20 10

Part 2 Products

2.1 GENERAL

- .1 Supply all materials required to complete the propane gas piping system as defined in the sections listed in Article 1.2.

2.2 PIPING

- .1 Refer to Section 20 20 10, Pipe and Pipe Fittings.

2.3 VALVES

- .1 Refer to Section 20 05 23, Valves and Strainers.

2.4 PROPANE TANK BLANKETS

- .1 Strap on tank electric tank heater for 7,587 L tanks. Explosion proof design to meet code requirement.
 - .1 Rated for Class 1, Division 1, Group D
- .2 Electric tank blanket provided by mechanical contractor:
 - .1 120V/1ph
 - .2 9m standard power cord.
 - .3 940W
 - .4 Vaporization capacity: 292kW
 - .5 Thermostat **not** required, coordinate with Div 26 for control/power

- .3 Heater to be with integral insulation and shaped to the tank diameter. Install as per manufacturers instructions with straps secured to tank.

2.5 PROPANE VAPORIZERS

- .1 Vaporizer for 7,587 L Tank. Explosion proof design to meet code requirement.
 - .1 Rated for Class 1, Division 1, Group D
- .2 Electric vaporizer provided by mechanical contractor:
 - .1 208V/3ph
 - .2 5.9kW, 16.4 Amps
 - .3 Vaporization capacity: 644kW
 - .4 Design Pressure: 250 PSI
- .3 250 PSI relief valve
- .4 Provide optional 'economy valve' for vapouriser, factory set for 22 psi to full open and 82 psi to full close position. 250 psi nominal operating pressure.
- .5 Approvals: CSA/ULC. ASME rated
- .6 Standby operation to be suitable for all operating conditions.
- .7 Standard of Acceptance: Torres Algas SDI TX50

2.6 POLYETHYLENE PIPE (PE): BURIED – OUTSIDE BELOW GRADE

- .1 Pipe: to CSA B137.4.
- .2 Fittings: to CSA B137.4.1.
- .3 Diameter as shown on drawings. Grade PE 3406, Series 160.
- .4 Jointing Methods: Joint pipe according to manufacturer's recommendations. Threading and gluing not permitted on polyethylene pipe.
 - .1 Socket fittings: to ASTM D2683.
 - .2 Butt Fusion.
 - .3 Compression fitted joints: to ASTM D746 with internal tubular stiffener.
 - .4 Use approved transition fittings when joining polyethylene pipe to other pipe materials.

2.7 HEAVY ENDS TRAP

- .1 Heavy ends trap to installation in propane system downstream of propane vapourizer
- .2 ASME Rated c/w CRN
- .3 Complete with internal filter element, pressure gauge and drain assembly with plug.

2.8 STEEL PROPANE TANKS

- .1 Propane tank will be supplied and installed by Owner's vendor.
- .2 Tank volumes, 7587L

- .3 Tanks to be horizontal type.
- .4 Conform to CSA B51.

2.9 PROPANE PRESSURE REGULATORS

- .1 Self-operated gas pressure regulator; malleable iron body. Size for full gas load to reduce gas pressure from 35 kPa to 2.7 kPa.
- .2 Acceptable Material: Fisher/Rego
- .3 CSA/CGA approved for propane gas.

Part 3 Execution

3.1 GENERAL

- .1 Install piping systems, equipment and components as defined in the sections listed in Article 1.2.
- .2 To CSA B149.1.

3.2 PROPANE TANK BLANKET

- .1 Install tank blankets on propane tank in accordance with manufacturer's instructions
- .2 Coordinate with Div 26 for connection of power and controls.
- .3 Test tank blanket in conjunction with controls, record voltage, amps and watt.
- .4 Work with the commissioning agent to verify all control and record all parameters in IOM.

3.3 HEAVY ENDS TRAP

- .1 Install on tank pad complete with supports.
- .2 Provide piping to trap as shown. Ensure valves and gauges are accessible.

3.4 PROPANE ELECTRIC VAPOURIZER

- .1 Install vaporizer(s) on a tank pad
- .2 Provide piping and power to vaporizer as required.
- .3 Provide solenoid, hydrostatic relief, excess flow and flex connections as shown.

3.5 PROPANE PRESSURE REGULATOR

- .1 Install service regulator adjacent to building wall in specified location.
- .2 Install service regulator and riser pipe in such manner as to prevent undue stress upon service pipe. For plastic service pipe, use steel pipe riser from below ground to regulator.
- .3 Ensure regulator vent has rain and insect proof opening and terminates away from building openings. Pipe interior regulator vents to the exterior.

3.6 PRESSURE AND LEAKAGE TESTS

- .1 Test Medium: Air, gas or inert gas such as carbon dioxide or nitrogen.
- .2 Fill piping with test medium for 24 hours prior to actual test.
- .3 For steel piping, subject pipe to pressure of 700 kPa for 24 hours.
- .4 For polyethylene piping, subject pipe to pressure of 350 kPa or 1.5 maximum operating pressure whichever is greater for 24 hours.
- .5 Supply pumps, connections, gauges and other necessary apparatus required for test.
- .6 Test will consist of visual inspection of the line for leaks and of measuring the pressure after 24 hours. No pipe installation will be accepted if leaks are detected or if pressure at end of test is less than 95% of original test pressure.
- .7 Replace all material found to be defective.

3.7 EXCAVATION

- .1 In roads, streets, driveways and parking areas, excavate depth of trench to provide 1200 mm of cover over pipe.
- .2 On private property, in open non-travelled areas, excavate depth of trench to provide 900 mm of cover over pipe.

3.8 PIPE LAYING

- .1 Lay pipe to specified alignment, to within tolerance of 200 mm.
- .2 Lay steel pipe on 50 mm cushion of compacted clay fill or on flat, undisturbed trench bottom. Backfill around sides and to top of pipe with clay fill thoroughly tamped in place.
- .3 Lower steel pipe carefully into trench to prevent damage to coating.
- .4 Lay polyethylene pipe on undisturbed trench bottom. Backfill around sides and to top of pipe with sand filled material and thoroughly tamp in place.
- .5 Provide recesses on trench bottom for couplings, fittings and valves to ensure bearing will occur along barrel of pipe.
- .6 Prevent dirt from entering exposed ends of pipe.
- .7 In roads, streets, driveways, and parking areas, provide pipe sleeve of diameter 50 mm greater than gas pipe diameter.
- .8 Lay service line pipe on proper grade to drain from building to gas main.
- .9 Lay gas pipe on properly graded trench bottom to prevent sags and low points in piping.
- .10 For steel pipe, wrap couplings and fittings with polyethylene tape and heat shrink over pipe.
- .11 For polyethylene pipe, provide tracer wire to aid in pipe location.

- .12 Whenever pipe is to be deflected vertically or horizontally, do not exceed amount of deflection recommended by manufacturer in order to maintain satisfactory piping.
- .13 Ensure minimum of 1000 mm between gas pipe and any underground structure that runs parallel to gas pipe.
- .14 Ensure minimum of 100 mm between gas pipe and any underground structure that crosses gas pipe

3.9 BUILDING REGULATOR INSTALLATION - PROPANE

- .1 Install service regulator adjacent to building wall in specified location.
- .2 Install service regulator and riser pipe in such manner as to prevent undue stress upon service pipe. For plastic service pipe, use steel pipe riser from below ground to regulator.
- .3 Ensure regulator vent has rain and insect proof opening and terminates away from building openings.

3.10 PROPANE TANK INSTALLATION

- .1 By propane tank supplier. Coordinate connection to regulator.
- .2 Provide structural concrete foundation and pad for tank placement to structural requirements. Coordinate with tank supplier for location, placement and type of restraint.
- .3 Provide bollards around propane tank for physical protection and chain link fence for vandalism protection. See architectural and structural.

3.11 PURGING

- .1 If air or inert gas was used for testing, purge lines with natural gas before using.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Provide the following components on hydronic systems:
 - .1 Manual and automatic air vents.
 - .2 Air separators.
 - .3 Relief valves and fittings.
 - .4 Pressure reducing valves.
 - .5 Expansion Tanks
 - .6 Fill Valves
 - .7 Pressure Bypass Valves

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Provisions - HVAC Section 23 05 01
 - .2 Tanks Section 20 15 00
 - .3 Hydronic Systems Section 23 21 13

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Air Separators : Bell and Gossett, Taco, Armstrong.
- .2 Relief Valves : Bell and Gossett, Armstrong, Taco.
- .3 Pressure Reducing Valves : Bell and Gossett, Armstrong, Taco.

2.2 MANUAL AIR VENTS

- .1 Provide manual air vents with 25 mm or line diameter pipe whichever is the greater, to form air collection chamber. Collection chambers to be a minimum of 150 mm high.

2.3 AUTOMATIC AIR VENT

- .1 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure where indicated.
- .2 Float: solid material suitable for 115°C working temperature.
- .3 Vent isolation valve: Class 600, regular port, threaded, bronze body, plated brass ball, brass gland and PTFE Teflon seat, wing handle, screwed.

2.4 IN LINE AIR PURGER

- .1 In line air purger with baffle and domed air cavity, ISO 9001:2015 certified factory fabrication, cast iron body, 8.6 Bar working pressure, air vent tapping, fill and expansion tank tapping, threaded connection.
- .2 Size: 25mm dia to 50mmdia.

material: Amtrol 44x Model Series.

2.5 FILL VALVE ASSEMBLY

- .1 Automatic fill valve system, fully adjustable to 690kPa, 13dia cold water connection.
- .2 Reduced pressure backflow preventor with ball isolation valves.

2.6 RELIEF VALVES

- .1 Provide ASME rated direct spring loaded type, lever operated non-adjustable factory set. Relief pressure as indicated.

2.7 PRESSURE REDUCING VALVES

- .1 20 mm pressure reducing valve complete with low inlet pressure check valve, removable strainer, Brass body and adjustable pressure of 55 kPa to 173 kPa or 175 kPa to 415 kPa to suit. Bell & Gossett.

2.8 EXPANSION TANK

- .1 Provide expansion tanks as described in Section 20 15 00, Tanks.

Part 3 Execution

3.1 FILL VALVE ASSEMBLY

- .1 Adjust pressure to suit system pressure.
- .2 Provide water connection from the building DCW system. Determine the nearest connection location on site and provide all piping and insulation to facilitate connection. Provide an isolation valve at the point of connection.

3.2 AIR VENTS

- .1 Provide manual type at system high points and at all heating equipment including terminal units, heat exchangers. Pipe air vent to serviceable location.
- .2 Where large air quantities can accumulate, provide enlarged air collection standpipe.
- .3 Provide automatic air vents in Mechanical rooms. Provide line size ball isolation valve.

3.3 IN-LINE AIR PURGER

- .1 Provide in-line air purger only where indicated on plans. Alternate use to vortex type separator is not acceptable.
- .2 Install with line size automatic air vent and where indicated hydronic fill connection.

3.4 RELIEF VALVES

- .1 Provide relief valves on pressure tanks, low pressure side of reducing valves, heating convertors, expansion tanks, heat exchangers and where indicated.

- .2 Pipe relief valve to nearest floor drain.
- .3 System relief valve capacity shall equal make-up pressure reducing valve capacity. Equipment relief valve capacity shall exceed input rating of connected equipment.
- .4 Where one line vents several relief valves, cross sectional area shall exceed sum of individual vent areas.

3.5 SYSTEM CAPACITY RECORDING

- .1 Contractor shall record quantity of water in systems. Data to be recorded in Operating and Maintenance Manuals.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Manufactured vents for forced vent propane fired appliances.
- .2 Manufactured vents for condensing appliances.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Supports, Anchors, Seals, Pipe and Duct Penetration, and Access Doors Section 20 05 29
 - .4 Condensing High Efficiency Fire Tube Boilers Section 23 52 23

1.3 QUALITY ASSURANCE

- .1 Vents and Venting Systems: Labeled by Underwriters' Laboratory of Canada.
- .2 The successful bidder for self-supporting venting shall provide to the general contractor, all relevant moments and loads that result from wind, earthquake and vortex shedding so that the contractor can design and install the suitable concrete base and building tie backs as required.

1.4 DEFINITIONS

- .1 Appliance: a device to convert gas into energy; the term includes any component, control, wiring, piping, or tubing required to be part of the device.
 - .1 Category I Appliance: this Category consists of draft-hood-equipped appliances, appliances labeled as Category I, and fan-assisted appliances for venting into Type B vents.
 - .2 Category II Appliance: an appliance that operates with a non-positive vent static pressure and with a flue loss less than 17%.
 - .3 Category III Appliance: an appliance that operates with a pressure and with a flue loss not less than 17%.
 - .4 Category IV Appliance: an appliance that operates with a positive vent static pressure and with a flue loss less than 17%.
- .2 Vent: that portion of a venting system designed to convey flue gases directly to the outdoors from either a vent connector or an appliance when a vent connector is not used.
 - .1 Type BH Vent: a vent complying with ULC S636 and consisting entirely of factory-made parts, each designed to be assembled with the others without requiring field fabrication, and intended for venting gas appliances.
- .3 Vent Connector: that part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and that may include a draft-control device.

- .4 Venting System: a system for the removal of flue gases to the outdoors by means of a chimney, vent connector, vent, or a natural or mechanical exhaust system.
- .5 Chimney: primary vertical shaft that encloses a vent.
- .6 Draft: flow of air or combustion products or both, through an appliance and its venting system.
- .7 Mechanical Draft: draft produced by a mechanical device such as a fan, blower, or aspirator which may supplement natural draft.
- .8 Forced Draft: a mechanical draft produced by a device upstream of the combustion zone of an appliance.
- .9 Induced Draft: a mechanical draft produced by a device downstream from the combustion zone of an appliance.
- .10 Natural Draft: a draft other than mechanical draft.
- .11 Condensing Appliance: Gas fired appliance with flue loss less than 17%.

1.5 QUALITY ASSURANCE

- .1 Vents and accessories forming part of the venting system shall be ULC labeled.
- .2 Comply with CSA B149.1-10 Natural Gas and Propane Installation Code
- .3 Comply with the National Building Code.
- .4 Comply with requirements of Appliance Listing.

1.6 REFERENCE STANDARDS

- .1 CAN/ULC-S605-M91 - Standard for Gas Vents
- .2 CAN/ULC-S609-M89 - Standard for Low Temperature Vents Type L
- .3 CAN/ULC-S629-M87 - Standard for 650 Degrees C Factory-Built Chimneys
- .4 CAN/ULC-S635-M90 - Standard for Lining Systems for Existing Masonry or Factory-Built Chimneys and Vents
- .5 ULC-S636 - Standard for Type BH Gas Venting Systems

1.7 SUBMITTALS

- .1 Manufacturer to review chimney design and appliance data and provide engineered solution for sizing and chimney parts.
- .2 Manufacturer to provide detailed system drawings and parts list.
- .3 Submit all design review and appliance data.
- .4 Comply with requirements of Section 20 05 05, General Documentation.

Part 2 Products

2.1 CONDENSING TYPE BH VENT

- .1 Application:

- .1 Boiler vents.
- .2 Type BH Vent: to ULC-S636 and UL 1738, insulated.
- .3 Application: listed Category 1 or Category II or Category III or Category IV appliances.
- .4 Service Temperature: flue gas temperature up to 288°C.
- .5 Fabrication: double walled, insulated, butt tungsten arc or laser welded.
- .6 Inner liner: AL294C stainless steel or Type 444 stainless steel.
- .7 Outer casing: Type 4441 stainless steel.
- .8 Insulation: 50mm mineral wool.
- .9 Seals: silicone gasket, gas and water tight.
- .10 Joints: captive nut and bolt system with locking bands.
- .11 Acceptable material: Security Chimney SSID.

2.2 ACCESSORIES

- .1 Appurtenances:
 - .1 Wall support brackets.
 - .2 Base support brackets.
 - .3 Anchor plate.
 - .4 Roof thimbles.
 - .5 Fire stops and plates.
 - .6 Roof guys, flashing and counter flashings.
 - .7 Other materials required to complete the assembly.
- .2 Terminations:
 - .1 Vertical (Vents): exit cones.

Part 3 Execution

3.1 VENT DESIGN

- .1 Manufacturer to complete detailed chimney and vent design including review of appliance data and provide engineered solution for sizing and chimney parts.
- .2 Manufacturer to provide detailed shop drawings and parts list.
- .3 Submit for review and approval.

3.2 VENT INSTALLATION

- .1 Install venting system, complete with accessories and appurtenances, in accordance with:
 - .1 Appliance manufacturers certified rating.
 - .2 Appropriate CAN/ULC standard for the venting system.
 - .3 Appliance manufacturers installation instructions.

- .4 National Building Code.
- .5 CAN/ULC B149.1-10.
- .2 Prior to ordering venting materials and prior to installation secure appliance listings and venting instructions from all appliance vendors listed in Article 1.2-Related Work Specified in Other Sections.
- .3 Do not penetrate flue gas chamber of vent with screws or mechanical fasteners.
- .4 Install venting with positive slope upward from appliance and to drains.
- .5 Suspend horizontal venting using trapeze hangers at 1500 mm centers.
- .6 Support chimney at bottom, roof and intermediate levels to manufacturers recommendations. The boiler vent is to be supported using structural steel stand to the floor except at the roof penetration. Support of the chimney for the full length from the roof is not acceptable. Provide shop fabricated structural steel stand. See drawing details.
- .7 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney.
- .8 Install exit cone on vertical chimney outlet.
- .9 Install counterflashing where chimneys pass through roof.
- .10 Provide for expansion and contraction of chimney.
- .11 Specified chimneys to be for full length from appliance connection to vent discharge. Use of shop or site fabricated breeching is not acceptable.
- .12 Provide for condensate trap and drain for all condensing appliances or drain through appliance vent connector where available.
- .13 Terminate all vents to requirements of CSA B149.1. Provide guy wires or bracing where detailed where heights exceed manufacturer recommendations for unsupported installation and where indicated. See drawing details.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This Section includes gas-fired, condensing boilers for glycol heating.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Refer to and comply with the following sections:
 - .1 General Mechanical Provisions Section 20 05 01
 - .2 General Documentation Section 20 05 05
 - .3 Systems Demonstration and Owner's Instruction Section 20 05 06
 - .4 Equipment Testing and Startup Section 20 05 08
 - .5 Valves and Strainers Section 20 05 23
 - .6 Pipe and Pipe Fittings Section 20 20 10
 - .7 Cleaning and Chemical Treatment - General Requirements Section 20 21 00
 - .8 Testing, Balancing and Adjusting Section 20 22 00
 - .9 Controls (Series) Section 20 30
 - .10 Hydronic System Specialties Section 23 21 30
 - .11 Venting for Natural Gas or Propane Fired Appliances Section 23 51 10
 - .12 Electrical Division 26

1.3 SUBMITTALS

- .1 Comply with Section 20 05 05, General Documentation.
- .2 Prior to close of tender, advise mechanical trade of venting requirements for this appliance (Refer to Section 23 51 10).
- .3 Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated.
- .4 Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, and method of field assembly, components, and location and size of each field connection.
 - .1 Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
- .5 Source Quality Control Tests and Inspection Reports: Indicate and interpret test results for compliance with performance requirements before shipping.
- .6 Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- .7 Maintenance Data: Include in the maintenance manuals specified in Division 1. Include parts list, maintenance guide, and wiring diagrams for each boiler.

1.4 QUALITY ASSURANCE

- .1 Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.
 - .1 The Terms “Listed” and “Labeled”: As defined in NFPA 70, Article 100.
 - .2 Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” as defined in OSHA Regulation 1910.7.
- .2 ASME Compliance: Boilers shall bear ASME “H” stamp and be National-Board listed.
- .3 FM Compliance: Control devices and control sequences according to requirements of FM.
- .4 Comply with NFPA 70 for electrical components and installation.
- .5 IRI Compliance: Control devices and control sequences according to requirements of IRI (GE GAP).
- .6 CSD-1.
- .7 SCAQMD Rule 1146.2 for low NOX equipment.

1.5 COORDINATION

- .1 Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.6 WARRANTY

- .1 General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Installing contractor shall provide one year of warranty parts and labor.
- .2 Special Warranty: Submit a written warranty, executed by the contractor for the heat exchanger.
 - .1 Warranty Period: Manufacturer’s standard, but not less than 10 years from date of Substantial Completion on the heat exchanger. Warranty shall be non-prorated and not limited to thermal shock. Additional 21 year thermal shock warranty on heat exchanger.

Part 2 Products

2.1 MANUFACTURERS

- .1 Available Manufacturers: Manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum five (5) years’ experience. Subject to compliance with requirements, manufacturers offering boilers that may be incorporated into the Work include, but are not limited to, the following.

- .2 Contractor shall furnish and install full condensing boiler[s] with input and output capacity as scheduled on the drawings with construction and performance as noted in these specifications.
- .3 Copper fin designs, or designs requiring "add-on" secondary condensing exchangers will not be considered.

2.2 GENERAL DESCRIPTION

- .1 Boiler to be large AASS firetube type complete with factory fabrication and assembly of burner, boiler, fittings, and automatic controls. The boiler, with all piping and wiring, shall be a complete factory integrated package. Each boiler shall be neatly finished, safety and fire tested, and properly packaged for shipping.
- .2 The entire Boiler design and construction shall be in accordance with Section IV of the ASME Code for hot water heating boilers with a maximum operating temperature of 250°F and maximum working pressure of 160 PSIG. The boiler shall be cULus certified as an indirect or direct vent boiler and comply with ASME CSD-1 Code requirements.

2.3 PERFORMANCE

- .1 Ratings based on 684m altitude.

2.4 FIRE TUBE STAINLESS STEEL BOILER

- .1 General: modulating, sealed combustion, power-vented, high efficiency gas-fired boilers with stainless steel fire-tube heat exchangers that use outside air for combustion (direct vent).
- .2 Efficiency: 95.0% AFUE, minimum DOE efficient as required by National Energy Conservation Act or ASHRAE 90.1.
- .3 Air quality: Independent laboratory rating of < 20 PPM for Oxides of Nitrogen (NOx) to meet the requirements of South Coast Air Quality Management District in Southern California and the requirements of Texas Commission on Environmental Quality.
- .4 Boilers to be suitable for heating inhibited propylene glycol solutions as specified.
- .5 Heat exchanger:
 - .1 Fire-tube stainless steel heat exchanger.
 - .2 The boiler must have non-metallic condensate collector to capture condensate from both, the vent system and heat exchanger.
 - .3 Fire-tube stainless steel heat exchanger to be fire tested and hydrostatically pressure tested at factory in accordance with ASME requirements
- .6 Factory Assembled and Tested.
- .7 Boiler(s) main components:

- .1 The combustion chamber will be sealed and located at the top which will be of counter flow design to assure that sediment and any lime that might form will fall to the bottom away from the crown sheet area.
- .2 Boiler(s) shall be supplied with a gas valve designed with negative pressure regulation (fan venturi effect "pulls" gas through valve rather than gas pressure "pushing" gas through valve). Negative pressure regulation enables the boiler to operate in a safe condition at 3.5" W.C. inlet gas pressure. The inlet (natural or propane) gas pressure to the boiler gas valve should be a minimum of 3.5" W.C. and a maximum of 14" W.C. If inlet gas pressure exceeds 13" W.C., a 100% lock-up type gas pressure regulator of adequate size must be installed in gas supply piping and adjusted to prevent pressure in excess of 13" W.C.
- .3 The burner shall be premix combustion type, made with stainless steel and a woven metal fiber outer covering to provide a wide range of modulating firing rates.
- .4 The boiler shall be equipped with a variable speed blower system capable of modulating the boiler firing rate.
- .5 The boiler shall be equipped with a device capable of controlling the air/fuel ratio through a 10 to 1 turndown ratio.
- .8 Controls:
 - .1 The control system shall have an electronic display for boiler set-up, boiler status, and boiler diagnostics.
 - .2 High limit temperature control with manual reset.
 - .3 Flue gas, outlet water temperature, and return water temperature sensors.
 - .4 Low water protection with manual reset.
 - .5 Boiler controller:
 - .1 cUL 353 listed.
 - .2 Built-in MODBUS communication.
 - .3 4 circulator contacts.
 - .4 Auxiliary input/output capability.
 - .5 Variable temperature zones that require no mixing valves.
 - .6 3 thermostat inputs.
 - .7 Outdoor reset for each priority.
 - .8 Zone and priority based setup options.
 - .9 2 Network and 2 local priorities available on each cascaded boiler.
 - .10 Flue gas, outlet water temperature, and return water temperature sensors.
 - .11 LCD display and 5 button interface.
 - .12 Alarm contact that triggers during manual lockout, flame failure, high temperature limit and low water cut off.
 - .13 Remote modulation capable of interfacing with Building Automation Systems and Multiple Boiler Systems.
 - .14 Ability to control additional heat demand.

- .15 Built-in freeze protection.
- .9 Venting and Combustion Air
 - .1 Boiler(s) must be capable of using outside air piped directly to boiler for combustion. Inlet and termination of these pipes must be connected to either through-the-roof or sidewall terminations as recommended by the manufacturer.
- .10 Boiler Trim
 - .1 Combination pressure-temperature gauge. Gauge dial clearly marked and easy to read.
 - .2 ASME certified pressure relief valve set to relieve at 30 PSIG maximum.
- .11 Condensate neutralizer:
 - .1 Factor installed within enclosure.
 - .2 Replaceable neutralization media, corrosion resistant, low profile tank, baffle or similar designed to ensure backflow cannot occur, NPT union connections or similar.
 - .3 Sized for appliance flow under typical duty operating cycle. Use of single neutralizer for multiple boilers is acceptable.
 - .4 Condensate trap as required.

2.5 BOILER FLUE VENTING

- .1 The Boiler shall be UCL certified as a direct vent boiler. Venting shall be accomplished with a stainless steel, double-wall, vent piping installed in accordance with applicable National and Local codes.
- .2 Venting to be stainless steel Type BH to Section 23 51 10, Venting for Natural Gas or Propane Fire Appliances.
- .3 Direct vent combustion air: to manufacturers listing and Section 23 51 10, Venting for Natural Gas or Propane Fire Appliances.

2.6 CAPACITY

- .1 See Equipment Schedules on drawing

2.7 ACCEPTABLE MATERIAL

- .1 Acceptable material: Weil McLain SVF

Part 3 Execution

3.1 EXAMINATION

- .1 Examine area to receive boiler for compliance with requirements for installation tolerances and other conditions affecting boiler performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 Boiler Manufacturer to advise mechanical trade on venting requirements (Refer to Section 23 51 10).
- .2 Comply with Section 20 05 08, Equipment Testing and Startup.
- .3 Install boilers level and plumb, according to manufacturer's written instructions and referenced standards.
- .4 Install gas and propane-fired boilers according to NFPA 54; CAN/CSA B149.1-10.
- .5 Support boilers on a minimum 100 mm thick concrete base, 100 mm larger on each side than base of unit.
- .6 Install electrical devices furnished with boiler, but not specified to be factory mounted.

3.3 CONNECTIONS

- .1 Connect gas piping and individual regulator, full size, to boiler gas-train inlet with union. Provide for each of the propane and natural gas-trains.
- .2 Connect hot water piping to supply and return boiler tapplings with shutoff valve and union or flange at each connection.
- .3 Install piping from safety-relief valves to nearest floor drain.
- .4 Connect breeching to boiler outlet, full size of outlet. The boiler shall operate under positive (Category IV) stack pressure. Vent material must be listed AL29-4C Stainless Double Wall Stack for condensing appliances.
- .5 Electrical: Comply with applicable requirements in Division 26. Provide transformers integrally factory wired where required.
- .6 Ground Equipment
 - .1 Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 CLEANING

- .1 Flush and clean boilers on completion of installation, according to manufacturer's written instructions.
- .2 After completing boiler installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes including chips, scratches, and abrasions with manufacturer's stainless steel polish.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

- .1 The following is a brief overview of the scope of this project. This list is only for guidance and is not inclusive of all work required for a complete an operational installation required under this contract:
 - .1 Review the site and confirm existing conditions prior to bidding.
 - .2 Provide new power branch circuiting and controls for the new propane boiler, pump distribution, and tank heater control systems.
 - .3 Provide demonstration and training for the Owner's Representatives.
 - .4 Complete set-up, programming, and testing as indicated.

1.2 DIVISION 26 DEFINITIONS:

- .1 The word "work" shall mean labor and any incidental items or services necessary for the proper installation and operation of the complete systems noted on these drawings and associated specifications.
- .2 The words "furnish", "provide", "include" or "carry" shall mean furnish, install, feed, make final connections, commission and leave in an approved complete operating condition.
- .3 The words "Consultant" or "Engineer" shall mean the electrical Consultant of record for this project.
- .4 The word "Owner" shall mean the Owner of the facility or their chosen representative.
- .5 The word "Contractor" or "EC" shall mean the awarded electrical contractor for this project.
- .6 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 INTENT

- .1 The Contractor shall provide all labour, materials, tools, and equipment required for the work, to provide a complete and operational installation.
- .2 It is the intent of the drawings and notes to provide a complete and workable installation. Any work, fitting and/or necessary material not specifically mentioned or shown on the plans, but necessary to complete the installation of a working system that has been functionally described in the contract documents, shall be furnished by the Contractor as if specifically mentioned herein and detailed.
- .3 The specifications and the drawings are complementary. Any item or subject which is omitted from one but included in the other is considered to be properly specified.
- .4 Whenever differences occur in the contract documents, the maximum conditions and most expensive interpretation are to be allowed for in the tender price.
- .5 Submission of a tender confirms that the contract documents and site conditions are accepted without qualifications.

- .6 The equipment locations and elevations shown on the drawings are approximate and must be verified before installation. Make changes where necessary to accommodate site conditions. Adjust locations as directed by the Consultant without change to the contract price, provided that changes are requested before installation, and they do not affect material quantities.
- .7 The Contractor shall be responsible for the proper fitting of material into the building as indicated on the drawings, without interference with other work, and shall make reasonable modifications in the layouts needed to prevent conflict with other trades, to provide access and for the proper execution of the work.

1.4 RELATED REQUIREMENTS

- .1 Electrical drawings are by nature schematic and indicate the general arrangement of the work. Electrical drawings are to be read with reference to the mechanical drawings and specifications included in the overall contract for this project.
- .2 The work shall be coordinated with the work of other trades including contract documents, shop drawings, and existing systems (where applicable).

1.5 CODES, REGULATIONS, PERMITS, FEES AND INSPECTIONS

- .1 Work shall be provided in accordance with the latest jurisdictionally adopted editions of the Canadian Electrical Code (CEC), National Building Code of Canada (NBC), Government of Yukon 2023 Propane System Design, Installation and Operation Standards, and all applicable codes/standards referenced by those codes and all other applicable federal, territorial, and local regulations including amendments.
- .2 Obtain and pay for all permits, fees and inspections required for this work.
- .3 In no instance shall the standard established by the drawings and specifications be reduced by code or otherwise.
- .4 Where conflict or discrepancies between Codes, Standards, Bylaws, Statutes, Specifications, Drawings, etc. exist, the most stringent requirement to apply.

1.6 EXISTING CONDITIONS

- .1 Contractor shall connect their work to various existing electrical systems. The new work shall be compatible with the existing system conditions.
- .2 Shutdown of existing systems for connection to existing services shall be coordinated with the Owner. Contractor shall submit requests where they affect the operation of the building systems at least one (1) week in advance of any required shutdown. The actual shutdown period shall be as short as possible and at a time agreed to by the Owner.
- .3 The Contractor shall report discrepancies between site conditions and drawings to the prime Consultant.
- .4 Do not scale drawings as they are diagrammatic and schematic in nature.
- .5 Verify all sizes, dimensions, and conditions before starting any work. Any deviations or issues shall be transmitted to the prime Consultant for review.

1.7 WARRANTY

- .1 Comply with warranty requirements defined in the Front-End Documents.
- .2 Furnish a written guarantee stating that all work executed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of substantial performance of work. The Contractor shall repair and replace any work which fails or becomes defective during the term of the guarantee/warranty, providing the operating and maintenance instructions have been complied with. The period of guarantee specified shall not, in any way, supplant any other guarantees of a longer period provided by Manufacturers or as called for in the project documents.

1.8 OWNER REQUIREMENTS DURING WARRANTY

- .1 Unless specified otherwise the Owner shall be responsible for all routine maintenance requirements as required in the manufacturer's instructions.

1.9 MATERIALS

- .1 Materials and equipment installed shall be new, full weight, and of quality specified. Use the same Brand or Manufacturer and model for each specific application.
- .2 Each major component of equipment shall bear the Manufacturer's name, address, catalogue, and serial number in a conspicuous place.
- .3 Replace materials or workmanship below specified quality and relocate work wrongly placed to satisfaction of the Consultant and at no cost to the Owner.
- .4 Install materials and equipment in a quality manner providing good workmanship by competent tradesmen.

1.10 AVAILABILITY OF EQUIPMENT AND MATERIALS

- .1 Make known in writing to the Consultant ten (10) days prior to the tender closing date any materials specified that are required to complete the work which are not locally supplied, or are not currently available, or will not be available for use as called for herein. Failing to do so, it will be interpreted that the most expensive alternate has been included in the tender price.

1.11 RECORD DRAWINGS

- .1 Contractor shall maintain, two (2) sets of white prints of drawings pertaining to the work. One (1) set of prints shall be kept on site and changes or deviations from the contract drawings shall be carefully noted as changes or deviations are made. All markups to be transferred to pdf format at project completion by the Contractor and submitted to the Consultant for review.

1.12 VALUATION OF CHANGES

- .1 Responses to all proposed change notices (PCN) are to include labour and materials backup broken out by the numbering provided in the PCN.
- .2 Labour units are to reflect those stated in the current edition of the national electrical contractors association (NECA) manual of labour units. Work of this

contract is considered normal installation conditions and labour units used for valuation of changes will reflect this.

- .3 All PCN costing shall be reviewed by the contract administrator using pricing standards based on the current edition of RSMeans "electrical change order cost data" pricing guide. This guide shall be the maximum cost allowed unless it can be shown through distributor quotation that materials pricing is inaccurate.

1.13 PROGRESS DRAW BREAKDOWN

- .1 The electrical contractor shall submit a detailed progress draw breakdown in the following categories and invoice a percentage against each category monthly or as required under the contract:
 - .1 Permits and mobilization,
 - .2 Demolition,
 - .3 Exterior site work, conduits, and wiring – Material,
 - .4 Exterior site work, conduits, and wiring – Labour,
 - .5 Interior conduit and branch wiring power – Material,
 - .6 Interior conduit and branch wiring power – Labour,
 - .7 Control system fabrication,
 - .8 Demonstration and training,
 - .9 Operation & maintenance manuals,
 - .10 Close-out and as-built drawings,

PART 2 PRODUCTS

2.1 SECTION NOT USED

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.2 CUTTING, PATCHING, AND PAINTING

- .1 Arrange and pay for all cutting, patching, and painting as required for the electrical installations. All saw cutting, drilling, coring, patching, and painting to be approved by Owner's Representative.
- .2 Provide complete x-ray prior to coring new holes. It is the Electrical Contractor's responsibility to ensure that any coring of holes through decks or floor slabs will not penetrate existing conduits, cables or mechanical equipment in or under deck or floor slabs. They shall, at their own cost, be responsible to take all actions required and as may be deemed necessary by the Consultant / Owner's Representative to correct any damage.

- .3 All painting and patching shall be done by qualified trades.

3.3 EXCAVATION AND BACKFILL

- .1 Where required, the EC shall perform all excavation and back-filling pertaining to the work. Fill material shall be equivalent to the surrounding material. The EC shall coordinate all work required.
- .2 Under no circumstances shall the EC proceed with digging without checking with pertinent parties and/or authorities regarding the existing underground services ducts, structures, domestic water / sanitary lines, etc.
- .3 When underground services/installations have to be connected to services supplied and installed by other parties, the EC shall fully coordinate the exact point of connection with other parties. This coordination has to be performed prior to excavation and installation.
- .4 All civil concrete, excavation, or backfill work including shoring and bedding shall be performed under the direction of the relevant professional (contract administrator or structural engineer) on the project. For directions, guidance, specification regarding this work, the EC shall contact the relevant professional(s).

3.4 GENERAL

- .1 Wire shall be installed in conduit and sized for the connected loads with protection as required.
- .2 Final connections and rough-in requirements to equipment shall be per manufacturers approved wiring diagrams, details, and instructions. It shall be the Contractor's responsibility to provide materials and equipment compatible with equipment actually supplied including all raceways, boxes, wiring, wiring devices, etc.

3.5 EQUIPMENT LOCATION

- .1 Verify exact location of equipment to be furnished by others prior to rough-in.
- .2 No extra charge for materials and labour shall be added to the contract for outlets moved within 3000mm (10'-0") from the location shown on the plans prior to rough-in.

3.6 MECHANICAL EQUIPMENT CONNECTION

- .1 Final connections to motors and other vibrating and/or rotating equipment shall be made with seal-tight flexible conduit with approved fittings (3m maximum length). Do not secure conduits or devices to ductwork or other mechanical equipment.
- .2 In general, all Mechanical control wiring will be by Mechanical Contractor unless otherwise noted. Where 120V power is required for mechanical equipment, wiring to the equipment terminals is the work of the electrical contractor (Div 26).
- .3 Identify to general contractor if EC bid includes thermostat conduit and wiring to facilitate proper scope delineation with mechanical controls contractor.

- .4 See Division 23 drawings for exact location of mechanical equipment. Provide service to and connect equipment as required.
- .5 Mechanical controls: Internal to outdoor units, controls conduit and wiring by controls contractor.

3.7 IDENTIFICATION

- .1 Identify source, voltage and load on all junction boxes. Use of indelible marker for these locations is acceptable.
- .2 Insulation colour of conductors and grounding/bonding to CEC 4-032.
- .3 All systems shall have their associated conduit/raceway colour coded via stripes of paint or adhesive strips which encircle the raceway. Ensure that banding is done after any required painting dictated for architectural/aesthetic continuity. Banding to be done within 1m of both sides of all wall, floor, and ceiling penetrations and every 5m thereafter. Where multiple conduit systems are run in parallel place the bands of each system in line with each other.
- .4 Building systems conduit colour coding to utilize the following colour scheme:
 - .1 120/208V: Grey,
 - .2 Grounding: Green,
 - .3 Building automation & controls: Orange,
 - .4 Security: Yellow,
 - .5 Telephone / data: White,
- .5 Provided updated panelboard directories for all modified panelboards. Directories to be type written, removable, and installed under clear plastic covers.
- .6 Provide lamacoid identification labels on the safety switch associated with each new piece of equipment. Mark circuit number, panel of origin and voltage on black and white limacoid with 6mm high letters. Mount labels with a minimum of two (2) screws.

3.8 DEMONSTRATION & TRAINING

- .1 Provide a minimum of two (2) 1-hour sessions to demonstrate and train staff and maintenance personnel on the operations and indications of the new propane heater control system. Coordinate session dates and times with The Owners' Representative minimum 10-days prior to session.

3.9 INSPECTIONS

- .1 Call the Consultant for inspections at the following stages of construction:
 - .1 Excavation & backfill,
 - .2 Rough-in,
 - .3 Substantial completion,
 - .4 Completion of deficiencies, and
- .2 Provide five (5) working days' notice for all inspections.

3.10 SUBSTANTIAL COMPLETION

- .1 Comply with the Front-End documents.
- .2 Prior to requesting substantial completion inspection, the following items must be complete:
 - .1 Project record drawings must be submitted to the Consultant for review.
 - .2 Maintenance manuals must be submitted to the Consultant for review.
 - .3 Provide certificate of acceptance from electrical safety authority (ESA).
 - .4 An exhaustive list of specific scope yet to be completed.
 - .5 If any of the above items have not been completed at the time of substantial completion inspection, and the letter of "assurance of professional field review and compliance" cannot be issued, any costs for subsequent inspections will be charged to the electrical contractor.

3.11 CERTIFICATE OF TOTAL PERFORMANCE

- .1 Comply with the requirements of the Front-End documents.
- .2 Prior to application for a statement of "Total Performance", the Contractor shall Provide the following to the Consultant:
 - .1 Report with photos indicating all noted substantial completion deficiencies have been resolved,
 - .2 Final Operational & Maintenance manuals, complete with As-built drawings,
 - .3 Warranty documentation.

3.12 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .3 Protect electrical boxes from ingress of construction dust. Clean boxes prior to device installation.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 This Section includes requirements for selective demolition and removal of electrical safety and control components including removal of conduit, junction boxes, and branch circuits to source (home run removal) and incidentals required to complete work described in this Section.

1.2 REFERENCES

- .1 CSA Group (CSA)
 - .1 CSA S350 M1980, Code of Practice for Safety in Demolition of Structures

1.3 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Salvage: Detach items from existing construction and deliver them to Owner's Representative ready for reuse.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .6 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB s, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 SITE CONDITIONS

- .1 Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.
- .2 Discovery of Hazardous Substances:
 - .1 It is not expected that Hazardous Substances will be encountered in the Work. Immediately notify Owner's Representative if materials suspected of containing hazardous substances are encountered.

1.5 SALVAGE AND DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from the project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain the Owner's property.
- .2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.
- .2 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Existing Conditions:
 - .1 Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid.
 - .2 Owner's Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.
 - .2 Notify Owner's Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.
 - .3 Prevent debris from blocking drainage inlets.
 - .4 Protect mechanical systems that will remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with the use of the building by the Owner and users is minimized

3.3 EXECUTION

- .1 Coordinate demolitions with facility operators. Plan all shutdowns with involvement of facility operators.
 - .1 Disconnect electrical circuits and feeders. Refer to plans for feeders which are to be spliced in future phases.
 - .2 Remove electrical devices and equipment including associated conduits, boxes, wiring, and similar items as indicated.
 - .3 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove tools or equipment after completion of work and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
 - .4 Disconnected feeder circuit breakers are to be re labelled respective as "SPARE".
 - .5 Place weatherproof blank cover plates on exterior outlet boxes remaining after demolition and removal activities.
 - .6 Remove existing conduits, boxes, cabling and wiring associated with removed electrical devices and equipment.
 - .7 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
 - .8 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.4 CLOSEOUT ACTIVITIES

- .1 Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131-M89 (R1994), Type TECK 90 Cable.
- .3 CAN/CSA-C22.2 No.51, Armoured Cables.

PART 2 PRODUCTS

2.1 BUILDING WIRING

- .1 Conductors: stranded for #8 AWG and larger. Minimum size: #12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Non-Jacketed.

2.2 ARMOURED CABLES

- .1 Is not permitted for use.

2.3 CONTROL CABLES

- .1 Type: LVT: soft annealed copper conductors, sized as indicated
- .2 Insulation: thermoplastic.
- .3 Sheath: cotton braid, thermoplastic jacket and armour of closely wound aluminum wire.
- .4 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated LVT: soft annealed copper conductors, sized as indicated
- .5 Insulation: PVC.
- .6 Shielding: paramagnetic material over each pair of conductors.

2.4 NON-METALLIC SHEATHED CABLE

- .1 Is not permitted for use.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform tests using method appropriate to site conditions.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Wire shall be installed in conduit and sized for the connected load(s) and protection as required, unless otherwise specified.
- .2 Minimum wire size shall be #12 AWG, unless otherwise stated. Home runs in excess of 30 m (100 ft.), for circuits protected by a 15 Amp overcurrent device, shall be #10 AWG.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association
 - .1 CSA C22.2 No. 41-13 (R2017), Grounding and Bonding Equipment

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 26 05 00
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for bonding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 PRODUCTS

2.1 EQUIPMENT

- .1 Bonding conductors: bare stranded copper, soft annealed, size as indicated.
- .2 Insulated Bonding conductors: green, copper conductor type RW90 XLPE.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

- .1 Protect exposed bonding conductors from mechanical injury.
- .2 Use mechanical connectors for bonding connections to equipment provided with lugs.
- .3 Soldered joints are not permitted.
- .4 Install bonding wire for flexible conduit, connected at both ends to grounding bushing. Neatly cleat the bonding wire to the exterior of flexible conduit.

3.2 BONDING

- .1 Bond all electrical equipment and enclosures including but not necessarily limited to following: frames of motors, starters, control panels, devices, etc.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation requirements for all outlet boxes, conduit boxes and fittings.

1.2 REFERENCES

- .1 Canadian Standards Association
 - .1 CSA C22.1 No. 18.1-13 (R2022) – Metallic Outlet Boxes,
 - .2 CSA C22.2 No.18-98 (R2003) Outlet boxes, conduit boxes and fittings and associated hardware.

PART 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 102mm square or octagonal outlet boxes for lighting fixture outlets.
- .3 102mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Surface mount boxes only permitted in service areas. Flush mounting for all finished areas.
- .2 Support boxes independently of connecting conduits.
- .3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6mm of opening.
- .5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .6 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .7 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation requirements for all conduit and accessories.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No.45-M1981 (R2008), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-17 (R2022), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83:M85 (R2022), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2:06 (R2021), Rigid PVC (Unplasticized) Conduit.
 - .6 CSA C22.2 No. 227.1:19 (R2023), Flexible Non-metallic Tubing.

PART 2 PRODUCTS

2.1 CABLES AND REELS

- .1 Provide cables on reels or coils.
 - .1 Mark of tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively DC applications.
- .4 Reel and mark shielded cables rated 2,001 volts and above.

2.2 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel, hot dipped galvanized steel, aluminum threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings, with expanded ends.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, steel aluminum, liquid-tight flexible metal.
- .6 Rigid PVC (unplasticized) conduit: to CSA C22.2 No. 211.2.
- .7 Flexible PVC conduit (ENT): to CSA-C22.2 No. 227.1.

2.3 CONDUIT FASTENINGS

- .1 One-hole malleable iron, steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two-hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1500mm on centre.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "elbows" where 90-degree bends are required, for 27 mm and larger conduits.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 21 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.
- .4 Watertight connector and couplings, set-screws are not acceptable.

2.6 FISHCORD

- .1 Polypropylene.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with Manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage, and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use electrical metallic tubing (EMT) in cast concrete.
- .4 Use rigid PVC conduit underground.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

- .6 Minimum conduit size for lighting and power circuits: NPS 21 mm (3/4").
- .7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 21 mm dia.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Install fish cord in empty conduits.
- .11 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .12 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel with or perpendicular to building lines.
- .2 Locate conduits 1.5 m away from infrared or gas fired heaters.
- .3 Group conduits wherever possible on suspended or surface channels.
- .4 Do not pass conduits through structural members except as indicated.
- .5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.

3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints with heavy coat of bituminous paint.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results – Electrical.

1.2 SUBMITTALS

- .1 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

PART 2 PRODUCTS

2.1 BREAKERS GENERAL

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating.

2.2 TRIP RATING 15 TO 200 AMPS -THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 OPTIONAL FEATURES

- .1 Include where indicated:
 - .1 shunt trip.
 - .2 auxiliary switch.
 - .3 motor-operated mechanism c/w time delay unit.
 - .4 under-voltage release.
 - .5 on-off locking device.
 - .6 handle mechanism.

2.4 ENCLOSURE

- .1 Mounted in NEMA 1 type enclosure, sprinkler proof as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results - Electrical.

PART 2 PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible, disconnect switch in CSA Enclosure type 1, size as indicated.
- .2 Provision for padlocking in ON-OFF switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Quick-make, quick-break action.
- .5 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses as indicated.

END OF SECTION

WATSON LAKE RECREATION CENTER, NEW BOILER BACKUP PLANT

BSC PROJECT: 2023-086

**ISSUED FOR TENDER
2026-01-16**

DRAWING INDEX:

MECHANICAL

M001 - LEGEND & SITE PLAN

M010 - SCHEMATICS

M100 - FLOOR PLAN

M011 - DETAILS & SCHEDULES

ELECTRICAL

E100 - ELECTRICAL LEGEND, SITE PLAN, DETAILS, & MECHANICAL SCHEDULES

E300 - DEMOLITION PLAN, POWER LAYOUT, & DETAILS

E600 - PANELBOARD SCHEDULES

ARCHITECTURAL

A1.01 - RENOVATION FLOOR PLAN & DETAILS



WATSON LAKE, YUKON

MECHANICAL

BUILDING SYSTEMS CONSULTING
1114 FRONT STREET
WHITEHORSE, YT Y1A 1A3

ELECTRICAL

BUILDING SYSTEMS CONSULTING
1114 FRONT STREET
WHITEHORSE, YT Y1A 1A3

ARCHITECTURAL

KOBAYASHI & ZEDDA ARCHITECTS LTD
26-1114 FRONT STREET
WHITEHORSE, YT Y1A 1A3

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PRELIMINARY
 NOT FOR CONSTRUCTION

3	ISSUE FOR TENDER	2026/01/16
2	ISSUE FOR 100% REVIEW	2025/07/18
1	ISSUE FOR 65% CLIENT REVIEW	2025/06/09
NO.	REVISION DESCRIPTION	YYYY/MM/DD

PROFESSIONAL SEAL / PERMIT TO PRACTICE



PERMIT TO PRACTICE
 BUILDING SYSTEMS CONSULTING INC.
 SIGNATURE: *J. Pike*
 Date: 2026-01-19
 PERMIT NUMBER PP725
 Association of Professional Engineers of Yukon



20-1114 FRONT ST Whitehorse, YT Y1A 1A3

PROJECT TITLE:
WATSON LAKE RECREATION CENTER, NEW BACKUP BOILER PLANT

LOCATION:
 WATSON LAKE, YUKON

DRAWING TITLE:
LEGEND & SITE PLAN

DRAWN BY: KT, CB DESIGN BY: CB CHECKED BY: JP

BSC PROJECT NO.: 2023-086 SCALE: AS INDICATED

DRAWING NO.:
M001



PIPING IDENTIFICATION AND SYMBOLS

—HGS—	HEATING GLYCOL RETURN
—HGR—	HEATING GLYCOL SUPPLY
—HWS—	HOT WATER HEATING SUPPLY
—HWR—	HOT WATER HEATING RETURN
—	PIPE CAP
—	PIPE BREAK
→	FLOW ARROW
↘	PIPING ELBOW DOWN
↗	PIPING ELBOW UP
+	PIPING TEE UP
+	PIPING TEE DOWN
+	PIPING TEE
⊘	ISOLATION VALVE (SEE SPECIFICATIONS FOR TYPES)
⊘	PRESSURE REDUCING VALVE
⊘	SWING GATE CHECK VALVE
⊘	BALANCING VALVE
⊘	RELIEF (R) OR SAFETY (S) VALVE
⊘	THREE WAY VALVE (WITHOUT ACTUATOR)
⊘	THREE WAY VALVE - WITH ACTUATOR (PNEUMATIC / MOTORIZED)
⊘	TWO WAY VALVE - WITH ACTUATOR (PNEUMATIC / MOTORIZED)
⊘	PRESSURE INDEPENDENT BALANCING VALVE
⊘	PRESSURE INDEPENDENT CONTROL VALVE
—	UNION CONNECTION
—	FLANGED CONNECTION
—	FLEXIBLE CONNECTOR
—	TEMPERATURE GAUGE
—	PRESSURE GAUGE AND COCK
—	FILTER
—	PUMP (REFER TO SCHEDULE)

HVAC SYMBOLS

###-###	RECTANGULAR DUCT
###-0	ROUND DUCT
###-###	DUCT WITH THERMAL INSULATION
###-###	DUCT WITH ACOUSTIC INSULATION
⊘	SQUARE ELBOW TURN (EXHAUST UP/DOWN)
⊘	SQUARE ELBOW TURN (INTAKE UP/DOWN)
⊘	ELBOW, ROUND, SMOOTH RADIUS (UP/DOWN)
+	TEE, 45 DEG., RECTANGULAR MAIN AND BRANCH
⊘	ELBOW, RECTANGULAR, SMOOTH RADIUS WITHOUT VANES (1.5 RW DEFAULT). SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION
⊘	ELBOW, ROUND, SMOOTH RADIUS (1.5 RW DEFAULT). SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION
⊘	ELBOW, RECTANGULAR, MITERED WITH TURNING VANES SEE SPECIFICATIONS FOR ADDITIONAL INFORMATION
FD	FIRE DAMPER
CD	CONTROL DAMPER
⊘	THERMOSTAT / THERMOSTAT IN LOCK BOX

CONTROLS AND INSTRUMENTATION

—	ELECTRIC/ELECTRONIC/ODC SIGNAL
XX	DEVICE FUNCTION SYMBOL (REFER TO CONTROLS IDENTIFICATION TABLE)
SCU #	LOCAL PANEL #
CPU #	MAIN CONTROL PANEL #
C	CLOSED
FO	FAIL OPEN
FI	FAIL INDETERMINATE
FC	FAIL CLOSED
FL	FAIL LOCKED
NO	NORMALLY OPEN
NC	NORMALLY CLOSED
SP	SET POINT
MV	MEASURED VARIABLE
HL	LOW WATER CUT OUT
LCL	HIGH LIMIT CUT OUT

DRAWING NOTES

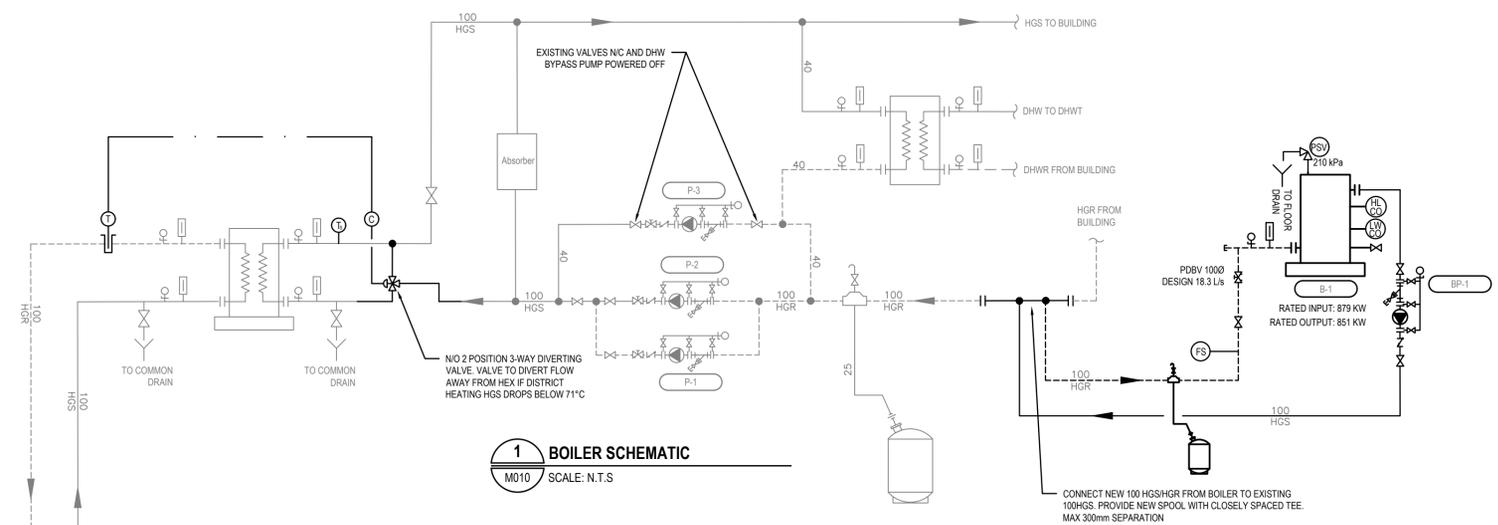
⊘	PLAN/DETAIL DESIGNATION
AAA	DRAWING NUMBER
⊘	SECTION DESIGNATION
AAA	DRAWING NUMBER
—	PLUMBING FIXTURE TAG (REFER TO SCHEDULE)
—	EQUIPMENT TAG (REFER TO TAGGING LEGEND)
⊘	KEYNOTE TAG

GENERAL NOTES

1	ALL WORK SHALL BE IN STRICT ACCORDANCE WITH THE CURRENT NATIONAL BUILDING CODE, NATIONAL PLUMBING CODE AND THE AUTHORITY HAVING JURISDICTION.
2	ALL EQUIPMENT IS TO BE INSTALLED IN STRICT ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS RECOMMENDATIONS. THE CONTRACTOR IS TO PROVIDE ALL VALVES, CONTROLS AND ACCESSORIES AS REQUIRED BY THE EQUIPMENT SUPPLIERS' MANUFACTURERS TO ALLOW FOR PROPER OPERATION, SERVICEABILITY AND WARRANTY.
3	DO NOT SCALE DRAWINGS. THE DRAWINGS ARE DIAGRAMMATIC AND LOCATIONS OF EQUIPMENT AND PIPING ARE APPROXIMATE. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND COORDINATE WITH ALL OTHER TRADES PRIOR TO FABRICATION AND INSTALLATION. MAKE ALLOWANCE FOR INSULATION, SUPPORTS AND ALL CLEARANCES.

100mm
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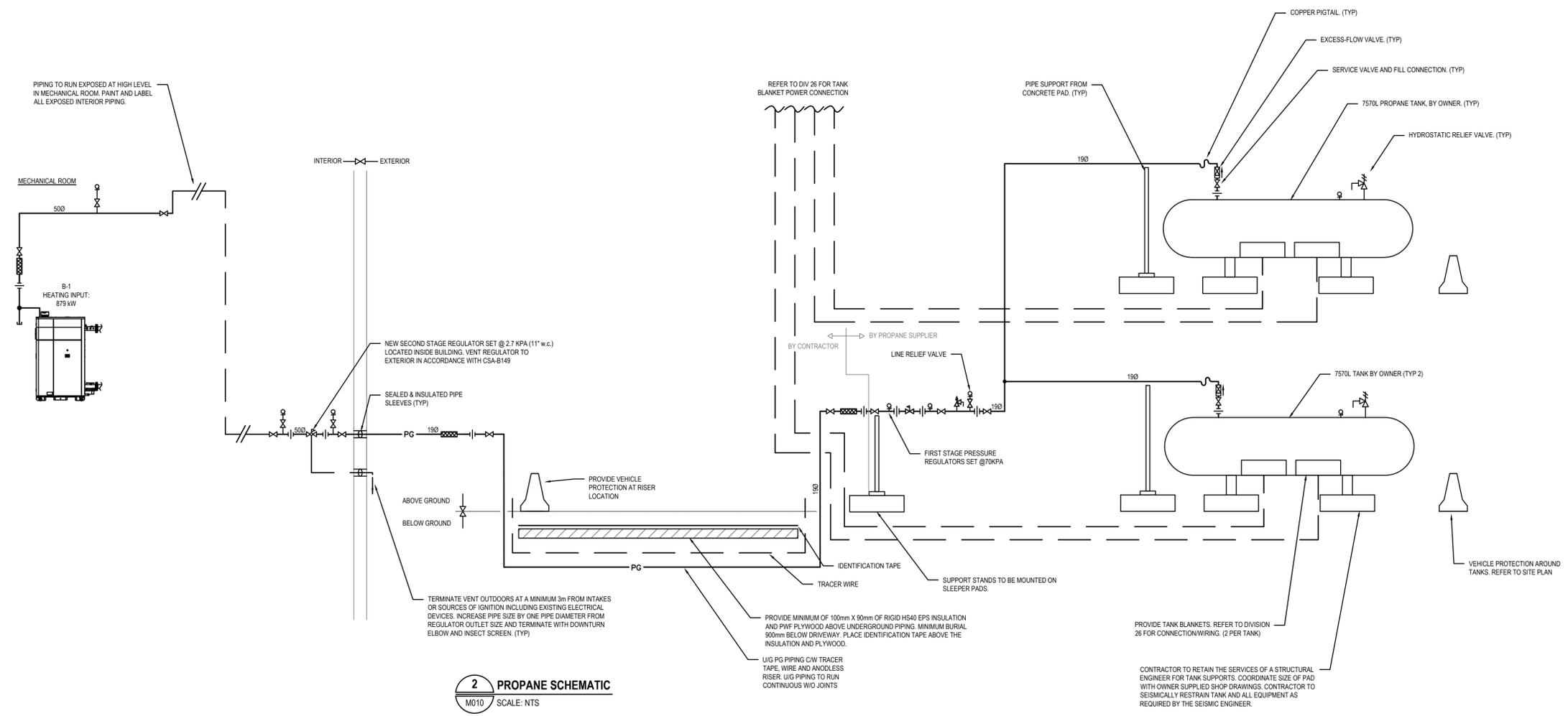
PRELIMINARY
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1 BOILER SCHEMATIC
 M010 SCALE: N.T.S



3 PHOTO: MECHANICAL ROOM EXTERIOR WALL
 M010 SCALE: N.T.S



2 PROPANE SCHEMATIC
 M010 SCALE: N.T.S

3	ISSUE FOR TENDER	2026/01/16
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 SIGNATURE: *J. Pike*
 Date: 2026-01-19
 PERMIT NUMBER PP725
 Association of Professional Engineers of Yukon

20-1114 FRONT ST Whitehorse, YT Y1A 1A3

PROJECT TITLE:
WATSON LAKE RECREATION CENTER, NEW BACKUP BOILER PLANT

LOCATION:
 WATSON LAKE, YUKON

DRAWING TITLE:
SCHEMATICS

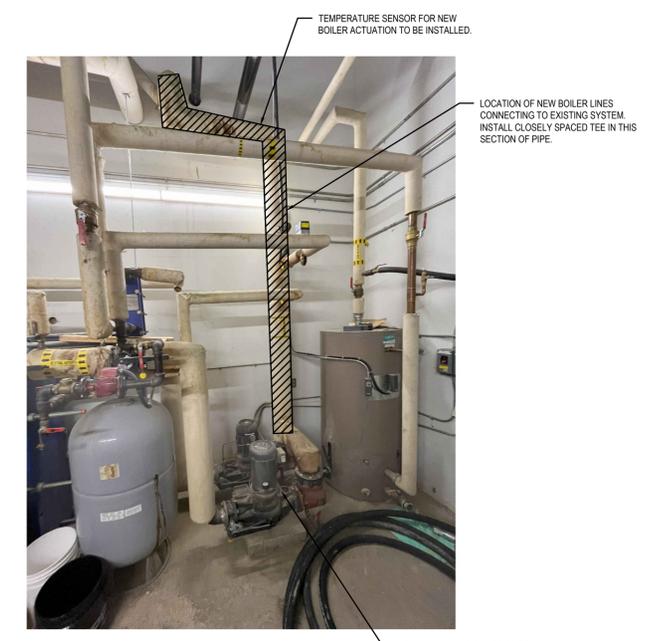
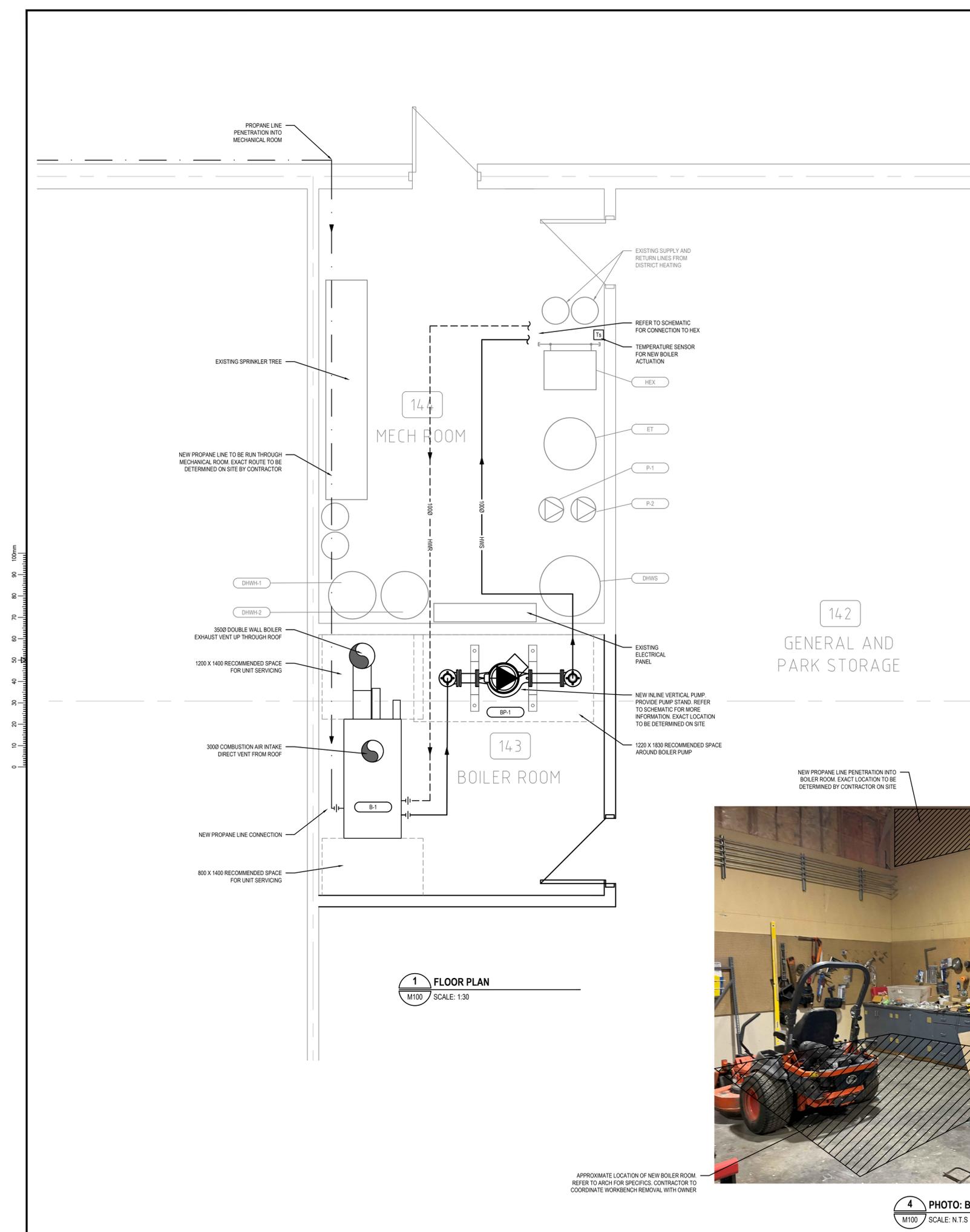
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BSC PROJECT NO.: 2023-086	SCALE: AS INDICATED	

DRAWING NO.:
M010

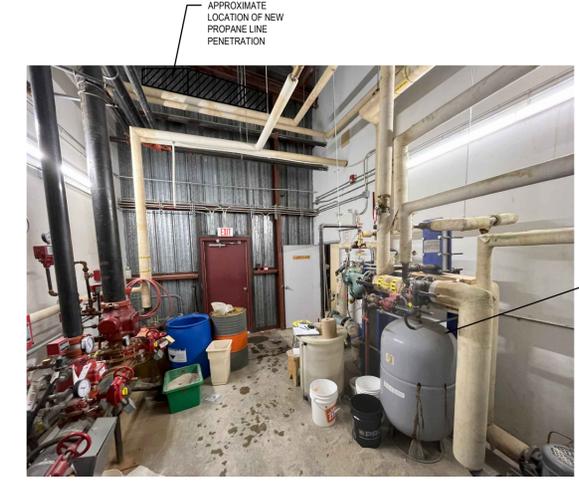


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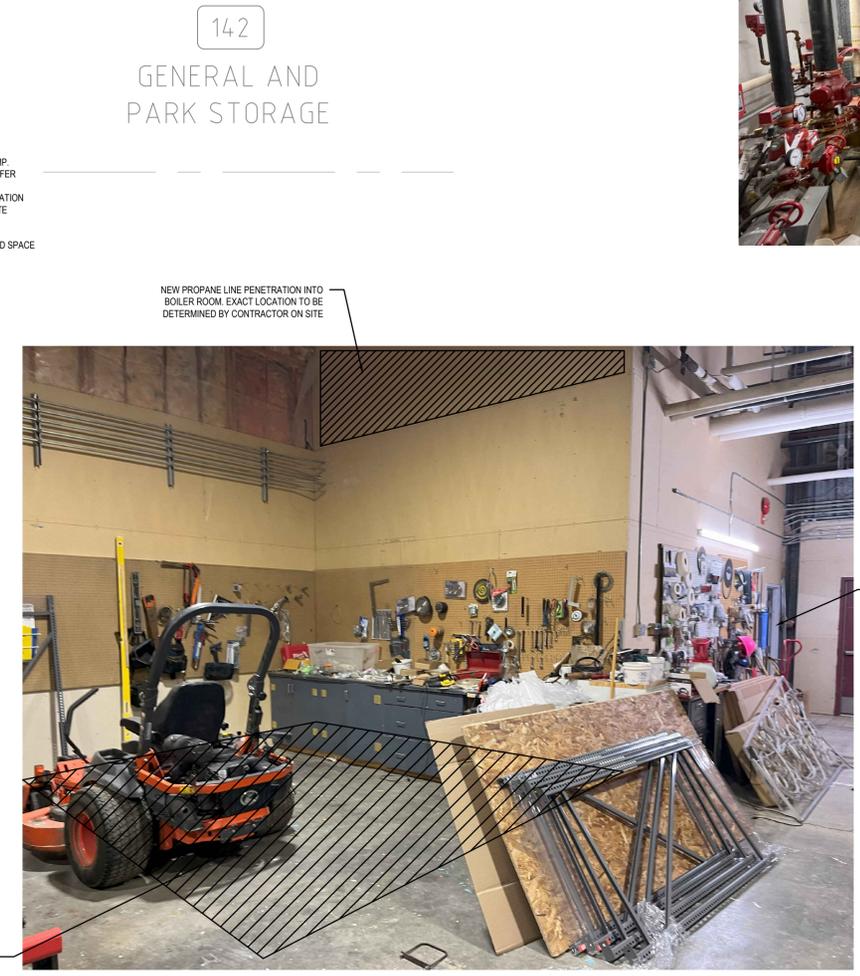
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2 PHOTO: MECHANICAL ROOM
 M100 SCALE: N.T.S.



3 PHOTO: MECHANICAL ROOM
 M100 SCALE: N.T.S.



4 PHOTO: BOILER ROOM LOCATION
 M100 SCALE: N.T.S.

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20-1114 FRONT ST Whitehorse, YT Y1A 1A3

PROJECT TITLE:
WATSON LAKE RECREATION CENTER, NEW BACKUP BOILER PLANT

LOCATION:
 WATSON LAKE, YUKON

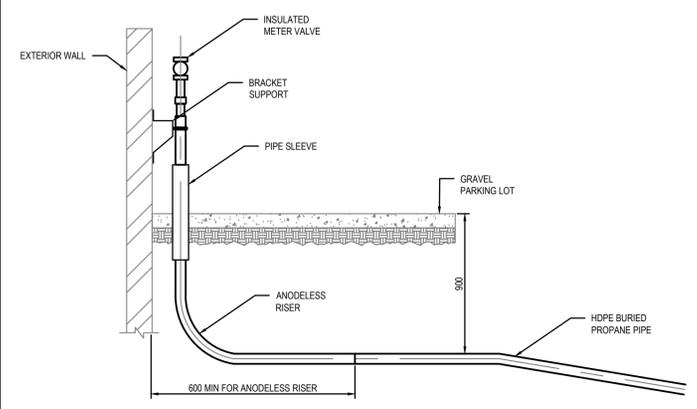
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FLOOR PLAN

DRAWN BY: KT, CB	DESIGN BY: CB	CHECKED BY: JP
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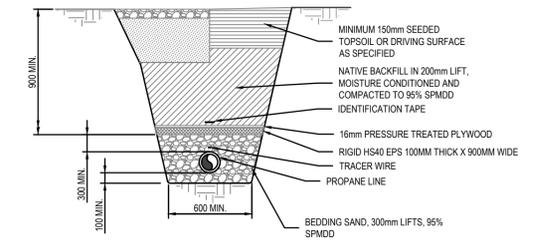
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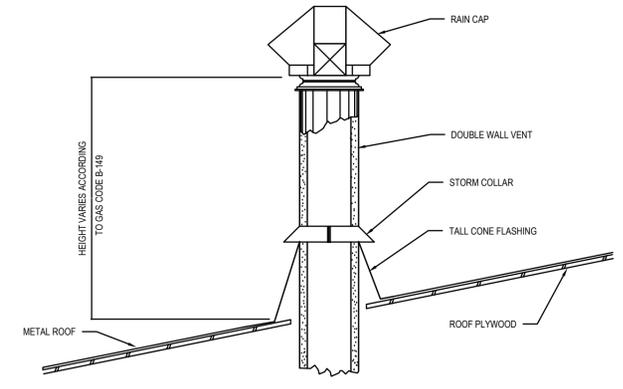
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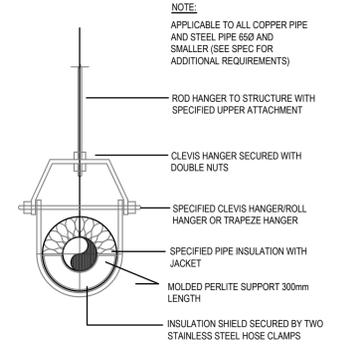
1 PROPANE RISER DETAIL
 M011 SCALE: NTS



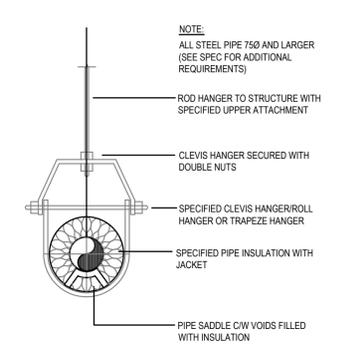
2 BURIED PROPANE PIPE TRENCH DETAIL
 M011 SCALE: NTS



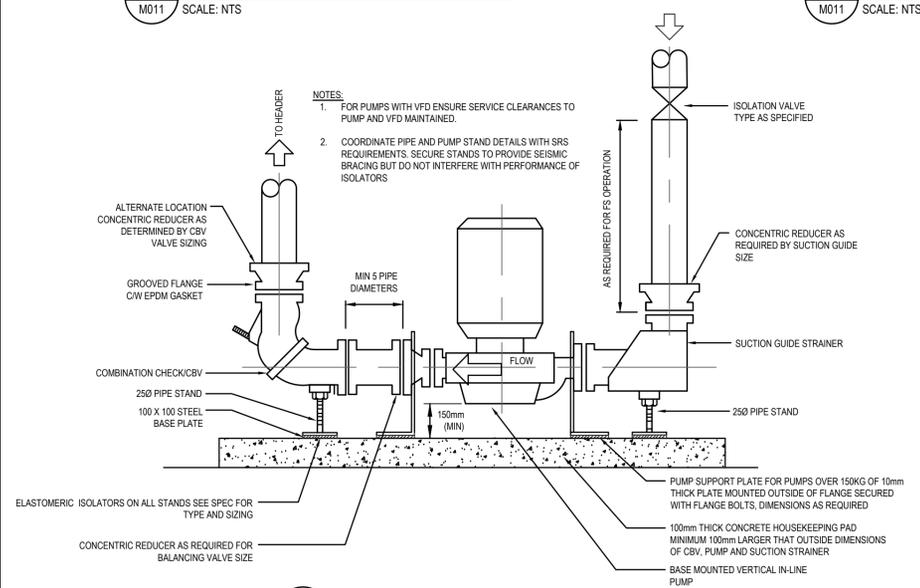
3 STANDARD EXHAUST CHIMNEY DETAIL
 M011 SCALE: NTS



4 STANDARD PIPE HANGAR DETAIL (TYPE 1)
 M011 SCALE: NTS



5 STANDARD PIPE HANGAR DETAIL (TYPE 2)
 M011 SCALE: NTS



6 BASE MOUNTED VERTICAL INLINE PUMP MOUNTING
 M011 SCALE: NTS

BOILER SCHEDULE													
TAG	DESCRIPTION	MANUFACTURER	MODEL	INPUT (KW)	OUTPUT (KW)	MAX. WORKING PRESSURE (KPA)	EFT (°C)	LFT (°C)	MAX GAS SUPPLY PRESSURE (KPA)	THERMAL EFFICIENCY (%)	DIMENSION LxWxH(mm) & WEIGHT (KG)	ELECTRICAL (V/Ph/Hz)	NOTES
B-1	PROPANE FIRED BOILER	PATTERSON-KELLY	SC-3000	879	852	1103	67	78	3.49	87.8	900x2130x2032 928	208-240/3/60	LOW WATER CUT OFF, FLOW SWITCH, CONDENSATE NEUTRALIZATION KIT

PUMP SCHEDULE										
TAG	DESCRIPTION	MANUFACTURER	MODEL	INLET & OUTLET SIZE (mm)	FLUID	FLOW RATE (L/s)	PR. HEAD (M)	POWER (KW)	ELECTRICAL (V/Ph/Hz)	NOTES
BP-1	NEW BOILER PUMP	GRUNDFOS	VLS 80123 150268 1922	200	PROPYLENE GLYCOL (50%)	18.3	14.9	55.9	460/3/60	

TANK SCHEDULE								
TAG	DESCRIPTION	MANUFACTURER	MODEL	TYPE	TANK VOLUME (L)	ACCEPTANCE VOLUME (L)	DIMENSION (mm)	NOTES
ET-1	EXPANSION TANK	AMTROL	AX-19V-DD	VERTICAL MOUNT	33	12.1	0305 x 559	

EXISTING HEAT EXCHANGER															
TAG	DESCRIPTION	MANUFACTURER	MODEL	TYPE	SOURCE				LOAD				DIMENSIONS LxWxH (mm)	NOTES	
					EWT (°C)	LWT (°C)	PRESSURE DROP (KPA)	FLOW (L/S)	FLUID	EWT (°C)	LWT (°C)	FLOW (L/S)			FLUID
HEX-1	HEAT EXCHANGER	ALFA LAVAL VICARB	V-45	SST	87.7	76.7	29.5	24.7	ETHYLENE GLYCOL (50%)	71	82	24.8	PROPYLENE GLYCOL (50%)	1148x502x1657	UNIT IS EXISTING. SCHEDULE FOR INFORMATION PURPOSES ONLY

NO.	REVISION DESCRIPTION	YYYY/MM/DD
3	ISSUE FOR TENDER	2026/01/16
2	ISSUE FOR 100% REVIEW	2025/07/18
1	ISSUE FOR 65% CLIENT REVIEW	2025/06/09

PROFESSIONAL SEAL / PERMIT TO PRACTICE

PERMIT TO PRACTICE
 BUILDING SYSTEMS CONSULTING INC.
 SIGNATURE: *J. Pike*
 Date: 2026-01-19
 PERMIT NUMBER PP725
 Association of Professional Engineers of Yukon

20-1114 FRONT ST Whitehorse, YT Y1A 1A3

PROJECT TITLE:
WATSON LAKE RECREATION CENTER, NEW BACKUP BOILER PLANT

LOCATION:
 WATSON LAKE, YUKON

DRAWING TITLE:
DETAILS & SCHEDULES

DRAWN BY: KT, CB DESIGN BY: CB CHECKED BY: JP
 BSC PROJECT NO.: 2023-086 SCALE: AS INDICATED

DRAWING NO.: **M011**

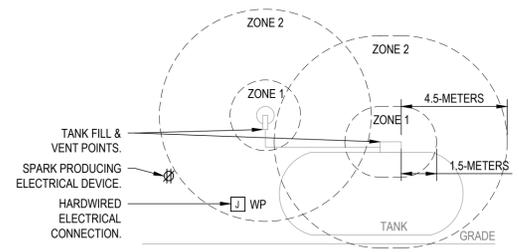
100mm
90
80
70
60
50
40
30
20
10
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ABBREVIATIONS	
A, AMP	AMPERES
AF	AMPERE (RATED) FUSE OR CB FRAME
AFB	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AT	CIRCUIT BRKR TRIP SETTING (AMPS)
AUTO	AUTOMATIC
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
CCT	CIRCUIT
CT	CURRENT TRANSFORMER
CU	COPPER
DIA	DIAMETER
DIV	DIVISION
DWG	DRAWING
EX	EXISTING TO REMAIN AS IS
FLA	FULL LOAD AMPERES
GFI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
KAIC	SHORT CIRCUIT RATING (RMS SYM. AMPS)
KVA	KILOVOLT-AMPERES
MAX	MAXIMUM
MCA	MINIMUM CIRCUIT AMPERES
MCML	THOUSAND CIRCULAR MILS
MIN	MINIMUM
NC	NORMALLY CLOSED
NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION
NO	NORMALLY OPEN
NTS	NOT TO SCALE
PH, Ø	PHASE
PNL	PANEL
PRI	PRIMARY
REQD	REQUIRED
RM	EXISTING TO BE REMOVED
RL	EXISTING TO BE RELOCATED
TYP	TYPICAL
ULC	UNDERWRITERS LAB CANADA
UON	UNLESS OTHERWISE NOTED
V	VOLTS
W/	WITH
W/O	WITHOUT
WP	WEATHERPROOF
XP	EXPLOSION PROOF
NOTE: NOT ALL SYMBOLS AND ABBREVIATIONS ARE USED	

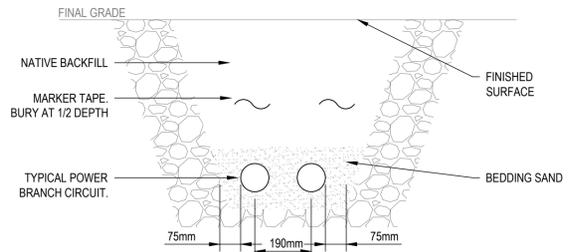
DISTRIBUTION AND DIAGRAMS SYMBOLS	
	PANELBOARD - (FLUSH/SURFACE)
	MOLDED CASE CIRCUIT BREAKER
	SWITCH - SINGLE THROW
	FUSED SWITCH
	KEYNOTE

ELECTRICAL POWER SYMBOLS	
	DUPLEX RECEPTACLE, 15A, 125V, 2P, 3W. (SLASH INDICATES MOUNTING ABOVE FINISH COUNTER)
	DUPLEX RECEPTACLE, 20A, 125V, 2P, 3W. (SLASH INDICATES MOUNTING ABOVE FINISH COUNTER)
	SPECIAL PURPOSE RECEPTACLE. TYPE AS INDICATED ON DRAWINGS. COORDINATE RECEPTACLE TYPE WITH ACTUAL EQUIPMENT PRIOR TO INSTALLATION
	DIRECT CONNECTION TO EQUIPMENT

ELECTRICAL EQUIPMENT SYMBOLS	
	MOTOR AND CONNECTION
	DISCONNECT SWITCH, NON-FUSED. PROVIDE SWITCH AMPACITY EQUAL TO OR GREATER THAN FEEDER AMPACITY, UON
	DISCONNECT SWITCH, FUSED. PROVIDE SWITCH AND FUSE AMPACITY EQUAL TO OR GREATER THAN FEEDER AMPACITY, UON
	JUNCTION BOX, WEATHER PROOF
	METER
	MECHANICAL EQUIPMENT TAG
	BRANCH CIRCUIT ID
	PUSH BUTTON



4 HAZARDOUS AREAS FOR PROPANE TANKS
 SCALE: NTS
 NOTES:
 1. CONFIRM EXACT LOCATION OF TANK FILL & VENT POINTS ON SITE WITH THE GENERAL & MECHANICAL CONTRACTORS PRIOR TO INSTALLATION.
 2. PERMANENT HARDWIRED ELECTRICAL CONNECTIONS MAY BE INSTALLED WITHIN THE CLEARANCE AREA IN A WEATHERPROOF ENCLOSURE.



3 ELECTRICAL TRENCH DETAIL
 SCALE: NTS
 NOTES:
 1. TOTAL TRENCH DIMENSIONS DEPEND ON THE QUANTITY & ARRANGEMENT OF ALL CONDUITS.
 2. MINIMUM BURIAL DEPTH: 600mm TO TOP OF CONDUIT.
 3. MINIMUM HORIZONTAL CONDUIT SEPARATION: 190mm ON-CENTER.
 4. MINIMUM TOP, BOTTOM & SIDE SAND LAYER: 75mm.

PROPOSED LOCATION OF NEW PROPANE TANKS. CONFIRM EXACT LOCATION AND ROUTE OF BRANCH CIRCUITING WITH THE MECHANICAL TRADE ON SITE.

APPROXIMATE LOCATION OF MECHANICAL ROOM. SEE DETAIL 1/E300.

APPROXIMATE LOCATION OF ELECTRICAL ROOM. SEE DETAIL 1/E300.



1 SITE PLAN
 SCALE: NTS

CALCULATED LOAD FOR SERVICES & FEEDERS PER CEC 22.1-21			
PROJECT:	WATSON LAKE REC CENTRE	DATE:	16-Jan-26
ID:	2023-086		
OCCUPANCY TYPE:	INDUSTRY or COMMERCIAL		
GENERAL AREA:	595 m ²		
TOTAL AREA:	595 m ²		
DESCRIPTION	WATTAGE	DEMAND	LOAD (W)
HISTORICAL PEAK DEMAND	175,680	100%	175,680
PROPANE BOILER, NEW	4,900	100%	4,900
BOILER PUMP, NEW	8,718	100%	8,718
PROPANE BLANKETS (4), NEW	3,760	100%	3,760
		SUB-TOTAL	193,058
AMPACITY AT 3-PHASE 120/208V			535.9 A
80% BREAKER DERATING			669.8 A
MINIMUM RECOMMENDED SERVICE SIZE			800 A

2 MECHANICAL SCHEDULE
 SCALE: NTS
 NOTES:
 1. EXISTING SERVICE IS RATED 3-PHASE 120/208V 1,000A.

02	ISSUED FOR TENDER	2026/01/16
01	ISSUED FOR 100% REVIEW	2025/07/18
NO.	REVISION DESCRIPTION	YYYY/MM/DD

PROFESSIONAL SEAL / PERMIT TO PRACTICE

PERMIT TO PRACTICE
BUILDING SYSTEMS CONSULTING INC.
 SIGNATURE: *[Signature]*
 Date: 01/16/2026
 PERMIT NUMBER PP725
 Association of Professional Engineers of Yukon

UNIT 20-1114 FRONT STREET WHITEHORSE, YT
 BSEng 44

PROJECT TITLE:
WATSON LAKE RECREATION CENTRE, NEW BACKUP BOILER PLANT

LOCATION:
 WATSON LAKE, YUKON

DRAWING TITLE:
ELECTRICAL LEGEND, SITE PLAN, DETAILS, & MECHANICAL SCHEDULE

DRAWN BY:	DESIGNED BY:	CHECKED BY:
MMS	MMS	AB
BSC PROJECT NO.:	SCALE:	
2023-086	AS INDICATED	
DRAWING NO.:		

E100

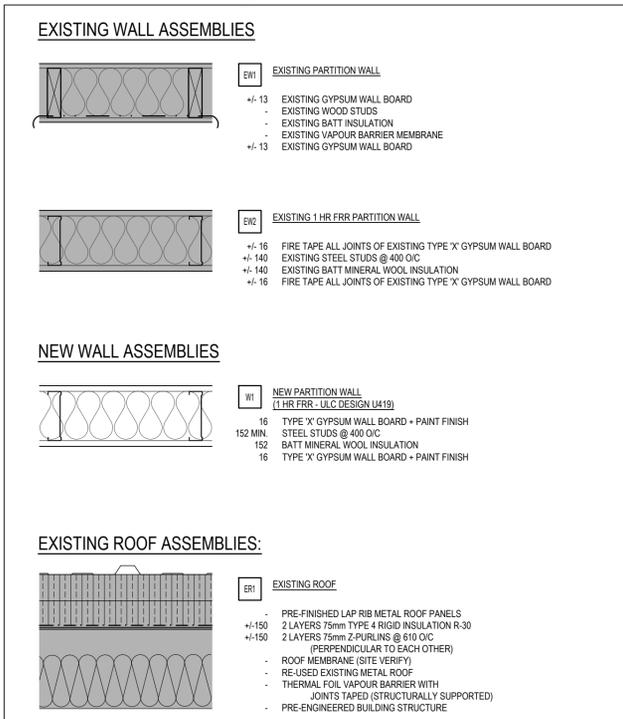
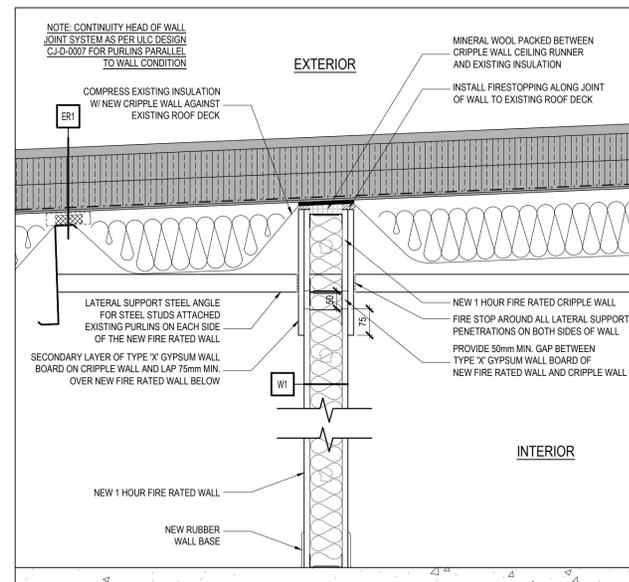
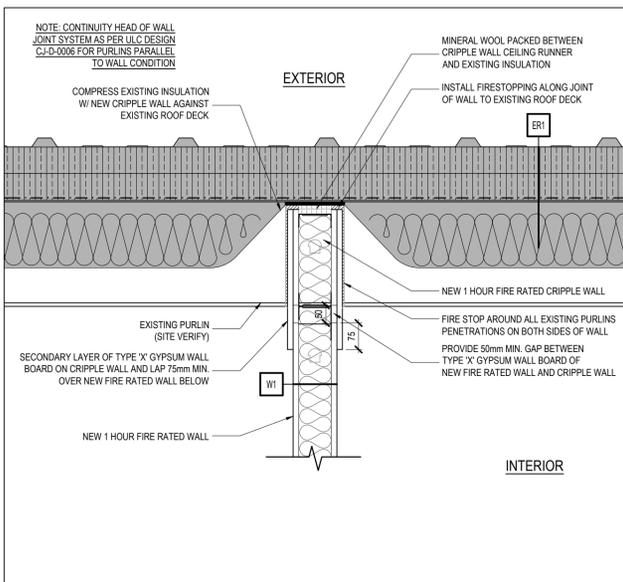
EQUIPMENT				NAMEPLATE RATINGS					POWER SOURCE			BRANCH CIRCUIT MINIMUM CONDUCTOR SIZE		STARTER		SUPPLIED		INSTALLED		CONTROLS		SUPPLIED		INSTALLED		FIRE ALARM	ITEM NOTES:
TAG	QTY	DESCRIPTION	LOCATION	V _L	∅	HP	W	FLA	MCA	MOP	PANEL	CONDUCTOR SIZE	TYPE	ACCS.	SUPPLIED	INSTALLED	TYPE	SUPPLIED	INSTALLED	TYPE	SUPPLIED	INSTALLED	FIRE ALARM	ITEM NOTES:			
BP-1	1	BOILER PUMP	143 BOILER ROOM	208	3	7.5	24.20	32.5		50	CDP-2	4 AWG Cu + BOND	INT VFD	HOA	E	E	DDC	M	M								
B-1	1	PROPANE BOILER	143 BOILER ROOM	208	3		13.60	17		20	M	10 AWG Cu + BOND		HOA	E	E	DDC	M	M								
PB-1,2,3 & 4	4	PROPANE BLANKET HEATER	EXTERIOR	208	1		940		5.65	15	M	12 AWG Cu + BOND		LRD	E	E	TS	E	E						PLUG-IN TYPE, PROVIDE RECEPTACLE. SEE DETAIL 2/E300.		

STARTER TYPE	ACCESSORY (ACCS.) TYPE	CONTROL TYPE	DIVISION	GENERAL NOTES:
CMS COMBINATION MAGNETIC	CONT CONTINUOUS OPERATION	AS AQUASTAT	G GENERAL	1) COORDINATE OVER-CURRENT PROTECTION DEVICE, CONDUCTOR SIZE, & ACCESSORIES BASED ON AS-SUPPLIED EQUIPMENT SHOP DRAWINGS & AS-INSTALLED BRANCH CIRCUIT LENGTHS.
FVNR FULL VOLTAGE NON-REVERSING	D/S DUTY / STANDBY OPERATION	BAS BUILDING AUTOMATION SYSTEM	E ELECTRICAL	2) COORDINATE WITH THE MECHANICAL & OTHER DIVISION PLANS & CONTRACTORS TO CONFIRM EQUIPMENT INFORMATION & LOCATION PRIOR TO INSTALLATION.
INT INTEGRAL TO UNIT	HOA HAND-OFF-AUTO	DDC DIRECT DIGITAL CONTROL	M MECHANICAL	3) STAND-ALONE DISCONNECTS ARE NOT REQUIRED WHERE LOCKABLE DISCONNECTS ARE SUPPLIED INTEGRAL TO THE EQUIPMENT.
MMS MANUAL MOTOR STARTER	L/L LEAD / LAG OPERATION	FS FLOW SWITCH		4) REFER TO PANEL SCHEDULES FOR CIRCUIT NUMBERS.
MPS MOTOR PROTECTION SWITCH	LRD LOAD-RATED DISCONNECT	H HUMIDISTAT		
LRR LOAD-RATED RELAY	O/L OVERLOAD PROTECTION	PS PRESSURE SWITCH	FIRE ALARM	
SS SOFT STARTER	PL PILOT LIGHT	RTS REVERSE ACTING THERMOSTAT	SD SHUT-DOWN	
VFD VARIABLE FREQUENCY DRIVE	R RELAY / CONTACT	TC TIME-CLOCK	SU START-UP	
	SIMP SIMPLEX OPERATION	TS THERMOSTAT	R RELAY INTERLOCK	

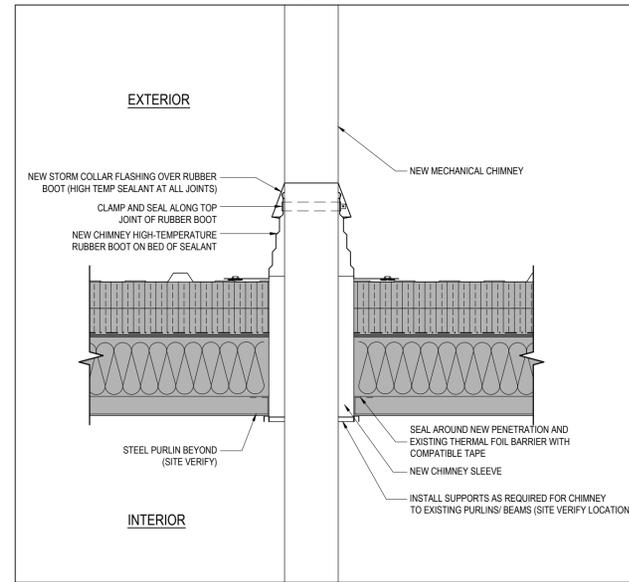
PANEL "M" LOADS		PANEL TYPE: MOUNTING: ENCLOSURE TYPE:		SD-NQDD SURFACE CSA 1		VOLTAGE: 120/208V, 3Ø, 4W		MAINS: 200 A		FED FROM: "CDP-1"		SC RATING: ~	
LOAD (W)	DESCRIPTION	BREAKER	CIRCUITS	BREAKER	DESCRIPTION	LOAD (W)							
			1										
			3										
			5										
			7										
			9										
			11										
			13										
			15										
			17										
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	EXISTING TO REMAIN		21		EXISTING TO REMAIN								
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	EXISTING TO REMAIN		49		EXISTING TO REMAIN								
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1,633	B-1	20A	69										
1,633			71										
			73		15A	PB-1	470						
			75		15A	PB-2	470						
			77		15A	PB-3	470						
			79				470						
			81		15A	PB-4	470						
			83				470						
TOTAL CONNECTED LOAD: X.X KW (X.XA)													

3 PANELBOARD "M" SCHEDULE
 SCALE: NTS
 NOTES:
 1. CONTRACTOR TO UTILIZE SPARE BREAKERS WHERE FEASIBLE.

PANEL "CDP-2" LOADS		PANEL TYPE: MOUNTING: ENCLOSURE TYPE:		SD-I-LINE SURFACE CSA 1		VOLTAGE: 120/208V, 1Ø, 3W		MAINS: 800 A		FED FROM: UTILITY		SC RATING: ~	
LOAD (W)	DESCRIPTION	BREAKER	CIRCUITS	BREAKER	DESCRIPTION	LOAD (W)							
			1										
			3										
			5										
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	FIRE ALARM	15A	17										
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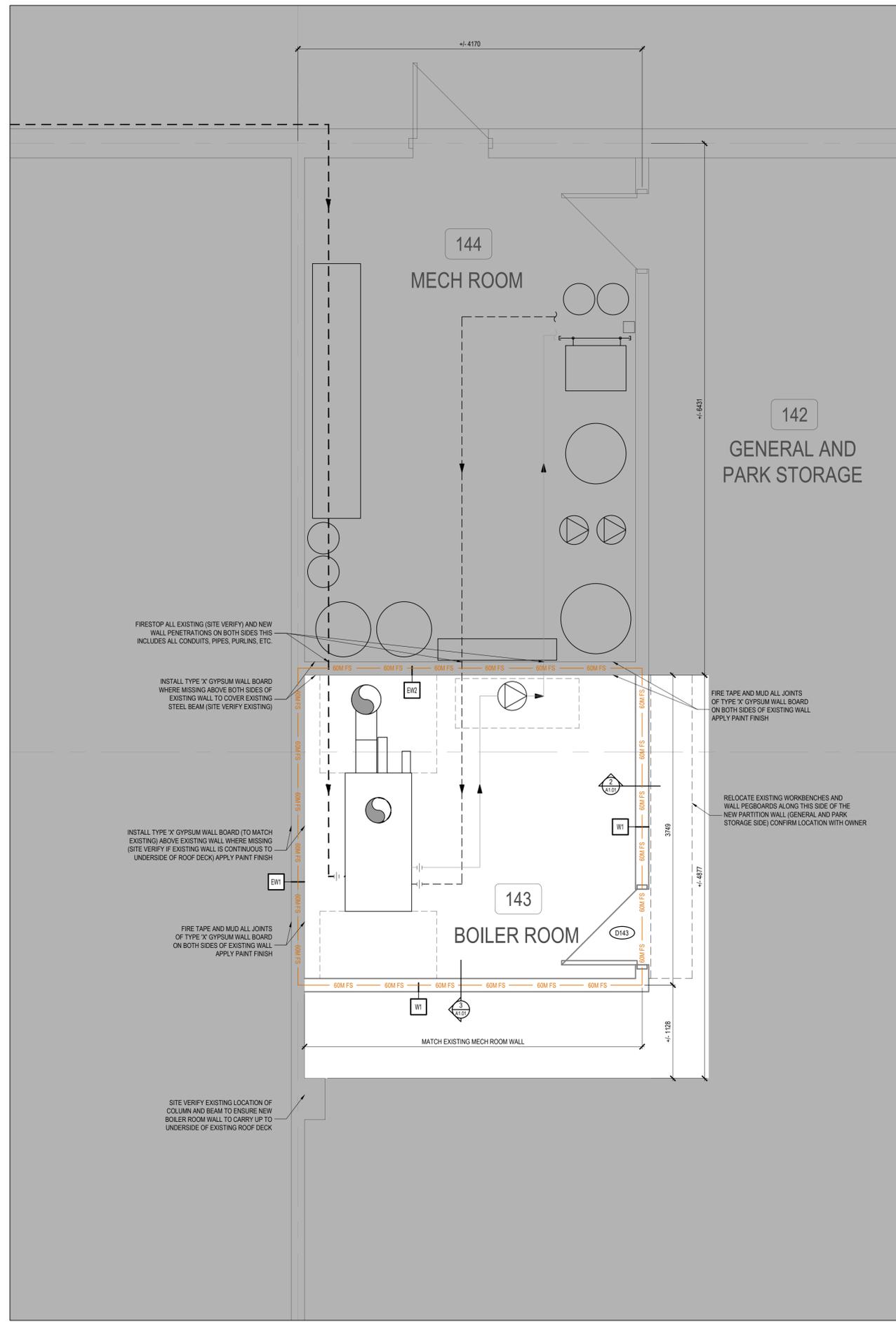
5 CONSTRUCTION ASSEMBLIES
SCALE NTS



GENERAL INFORMATION				DOOR				FRAME				COMMENTS					
DOOR #	ROOM #	ROOM NAME (RENOVATION)	HARDWARE GROUP	DOOR TYPE	RATING (MINS)	DOOR SWING	WIDTH	HEIGHT	THICKNESS	MATERIAL	DOOR FINISH		GLAZING	TYPE	MATERIAL	FRAME FINISH	FRAME TYPE
D143	143	BOILER ROOM	1	-	45	RH	915	2134	45	HM	PT	-	-	WS	PT	-	N/A

FACE/FINISH	DOOR CONSTRUCTION	FRAME
PT PAINT	HM HOLLOW METAL	WS WELDED STEEL

6 DOOR SCHEDULE
SCALE NTS



1 FLOOR PLAN - RENOVATION
SCALE 1:30

LEGEND

EXISTING COMPONENTS

60M FS LINE OF NEW 1 HOUR FIRE RATING

GENERAL NOTES

ALL WORK SHALL CONFORM TO THE 2020 EDITION OF THE NATIONAL BUILDING CODE OF CANADA (NBC), AND APPLICABLE MUNICIPAL OR TERRITORIAL BY-LAWS AND REGULATIONS.

THE AUTHORITY HAVING JURISDICTION MAY HAVE ADDITIONAL REQUIREMENTS TO, OR PERMIT RELAXATION FROM, THE STANDARDS OF THE NBC. THE AUTHORITY GOVERNS. ALL VARIATIONS ARE TO BE CONFIRMED BY THE ARCHITECT PRIOR TO IMPLEMENTATION.

ALL WORK SHALL BE EQUAL IN ALL RESPECTS TO GOOD BUILDING PRACTICES.

WRITTEN DIMENSIONS SHALL TAKE PRECEDENCE OVER SCALED DRAWINGS. CONTRACTOR TO VERIFY ALL WRITTEN DIMENSIONS WITH CONDITIONS FOUND ON SITE.

THE ARCHITECT WILL BE PROVIDING FIELD REVIEWS ON THIS PROJECT. THE ARCHITECT IS TO BE INFORMED OF PERTINENT SITE CONDITIONS AFFECTING THE WORK OR DESIRED FIELD ADJUSTMENTS TO THE DESIGN PRIOR TO COMMENCING WORK. ALLOW REASONABLE NOTIFICATION OF NECESSARY FIELD REVIEWS.

THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS AND DETAILS BEFORE PROCEEDING WITH CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ARCHITECT.

CONTRACTOR TO COORDINATE THE WORK OF ALL TRADES.

CONTRACTOR SHALL ENSURE THAT THE WORKS COMPLY WITH ALL APPLICABLE SAFETY CODES AND REGULATIONS.

NO CUTTING OR BORING OF STRUCTURAL MEMBERS SHALL BE DONE WITHOUT THE PRIOR APPROVAL OF THE ENGINEER.

CONTRACTOR TO BE RESPONSIBLE FOR REMOVAL OF DEBRIS AND CLEANLINESS DURING CONSTRUCTION AND TO THOROUGHLY CLEAN ENTIRE BUILDING ON COMPLETION OF WORK.

kobayashi+zedda

Phone 867 633 8874 | Fax 867 633 4602 | info@kza.yk.ca
26 - 1114 Front Street, Whitehorse, YT, Y1A 1A3, CANADA

NOTE

Written dimensions shall have precedence over scaled dimensions. Contractor shall verify all dimensions and conditions on the job and the architect shall be informed of any variations from dimensions and conditions shown on the drawings. Shop drawings shall be submitted to the architect for review before proceeding with fabrication dimensions in millimeters unless noted otherwise.

#1 2025-01-16 ISSUED FOR TENDER
REVISION ISSUE SET
SHEET INITIATION

PROJECT

WATSON LAKE REC. CENTRE - NEW BOILER BACKUP PLANT

KZA PROJ. # 2025-28 LOCATION WATSON LAKE, YUKON
CLIENT WATSON LAKE

DRAWINGS

RENOVATION FLOOR PLAN & DETAILS (SHEET 1 OF 1)

PROJ. NORTH

DRAWN BY: ALDL CHECKED BY: RM FILE NAME: 2025-28.DWG

SHEET

A1.01