



SPECIAL NOTICE:

ACCREDITED OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS (OHSMS) REQUIREMENT FOR CONSTRUCTION BIDS

HALTON REGION HAS NEW HEALTH & SAFETY REQUIREMENTS FOR CONSTRUCTION BIDS. PLEASE NOTE THE FOLLOWING:

- a. Bidders are required to have third-party Occupational Health and Safety Management Systems (OHSMS) accredited by the Ontario Ministry of Labour, Immigration, Training and Skills Development's Chief Prevention Officer.
- b. Constructors/Consultants will be required to complete a Health & Safety Training module provided by Halton Region.

As of January 2026, the Region is phasing in the requirement for Bidders to have third-party Occupational Health and Safety Management Systems (OHSMS) accredited by the Ontario Ministry of Labour, Immigration, Training and Skills Development's Chief Prevention Officer. CPO-accredited OHSMS can be found here: <https://www.ontario.ca/page/supporting-ontarios-safe-employers-program>. The phase-in plan is as follows:

- January 2026: Applies to construction projects with a value of **greater than \$25 million**
 - July 2026: Applies to construction projects with a value of **greater than \$10 million**
 - July 2027: Applies to construction projects **equal to or above \$1 million and for select projects**
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The Regional Municipality of Halton

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THE REGIONAL MUNICIPALITY OF HALTON
on behalf of
HALTON COMMUNITY HOUSING CORPORATION

REQUEST FOR QUOTATIONS

FOR

HEAT PUMP UPGRADES AT
540 PLAINS RD. E, BURLINGTON, ON

QUOTATION #: Q-955-26

BIDS SHALL BE SUBMITTED VIA THE BIDDING SYSTEM AT
<https://haltonregion.bidsandtenders.ca>

******* ELECTRONIC SUBMISSIONS ONLY *******



Supplementary Instructions to Bidders

Contract No. Q-955-26

Heat Pump Upgrades at 540 Plains Rd. E, Burlington, ON

1. Key Bid Dates:

a. Bid Issue Date: Tuesday, May 12, 2026.

b. Pre-Bid Meeting and Site Visit:

Non-Mandatory Site Meeting: Wednesday, May 20, 2026, at 10:00 a.m. ET.

The non-mandatory site meeting will be held at 540 Plains Road E., Burlington, ON L7T 2E3.

Attendees will be met outside the main entrance (note: main entrance faces Sanford Drive). The site meeting will begin promptly at the designated time. Bidders are encouraged to arrive prior to the time indicated above in order to sign in. Refer to section 7 “Pre-Bid Meeting, Site Visit and Site Conditions” of the Instructions to Bidders for further information.

c. Question Deadline Date: Monday, June 1, 2026, at 4:00 pm ET

Any questions regarding this bid document are to be submitted in writing through Halton Region’s Public Procurement Website (<https://haltonregion.bidsandtenders.ca>) by using the “Submit a Question” feature. Refer to section 2 “Any Communications” of the Instructions to Bidders for further information.

d. Bid Closing Date and Closing Time:

Tuesday, June 9, 2026, at 2:00 pm ET

e. Irrevocability Period: 90 days from the Closing Date.

Please note, should the Bidder complete any obligations, including in submitting completed documentation, after the Irrevocability Period, the Irrevocability Period shall be extended by the number of days of the delay and the Bidder shall not be entitled to an extension of Contract Time or delay claims as a result of said delay.

2. Key Construction Milestones

- a. **Commence Work:** The successful Bidder shall commence the Work within five (5) days from the date of the Notice of Award.
- b. **Ready-for-Takeover:** The successful Bidder shall achieve Ready-for-Takeover by October 9, 2026.
- c. **Completion:** The successful Bidder shall achieve Completion by October 16, 2026

Please note, in the event of any conflicting or inconsistent provisions between the Agreement Term Sheet and these terms and conditions, the Agreement Term Sheet shall always prevail and take precedence with respect to any such conflicting or inconsistent provisions.

3. Vendor Performance Management Policy

The Vendor Performance Management Policy shall not apply to the successful Bidder's Contract.

4. Bid Compliance & Posting of Results

Upon closing, Bids will be reviewed by the Region for bid irregularities and to verify that all mandatory requirements (if any) set out in the Bid Documents have been satisfied (the "Compliance Check"). For Request for Quotations, names of Bidders will be acknowledged only. For Request for Tenders, once the Compliance Check has been completed, the Bidding system will be updated to display the name of the Bidder with the lowest compliant Bid and the respective Bid amount.

NOTE: Information displayed on the Bidding System is unofficial for Bids in "Closed" status.

5. Health & Safety

- a. All *Contractors* and *Consultants* shall complete the *Owner's* 'Construction Health & Safety for Consultants and Constructors' training module, available at <https://elearning1.innovatia.net/topclass/media/Halton/CHSCC/story.html> prior to commencement of any *Work* under this *Contract* and immediately upon any expiry of the previous certification during which the *Work* is ongoing, including until completion of the *Warranty Period*.
- b. When bidding, the *Owner* requires its *Contractors* to possess and maintain an Occupational Health and Safety Management System Accredited by the Ontario Ministry of Labour, Immigration, Training and Skills Development's Chief Prevention Officer until expiry of the *Warranty Period* where the *Work* constitutes *Designated Works*. For the purposes of this *Contract*, the *Work* shall constitute *Designated Works* as follows:

- Where the *Effective Date* of the *Contract* is on or between January 1, 2026, to June 30, 2026, the *Work* shall constitute *Designated Works* if the *Contract Price* is greater than \$25,000,000.00;
- Where the *Effective Date* of the *Contract* is between July 1, 2026, to June 30, 2027, the *Work* shall constitute *Designated Works* if the *Contract Price* is greater than \$10,000,000.00;
- Where the *Effective Date* of the *Contract* is on or after July 1, 2027, the *Work* shall constitute *Designated Works* if the *Contract Price* is greater than \$1,000,000.00.

Without limiting the foregoing and regardless of the *Effective Date* and *Contract Price*, the *Owner*, in its sole discretion, may determine that the *Work* constitutes *Designated Works* by indicating such designation in the *Contract Documents*.

6. List of Bid Documents

Below is a list of Bid Documents included with this Request for Quotations:

Bid Documents	No. of Pages
Special Notice – OHSMS Requirement for Construction Bids	1
Cover Page	1
Supplementary Instructions to Bidders	3
Instructions to Bidders	50
CCDC 2 - 2020 Stipulated Price Contract	30
CCDC 2 - 2020 Supplementary Conditions	63
Appendix 1 to the Supplementary Conditions – Agreement Term Sheet	1
Appendix 2 to the Supplementary Conditions – Proper Invoice Requirements	4
Appendix 3 to the Supplementary Conditions – Insurance	3
Appendix 4 to the Supplementary Conditions – Designated Works	1
Attachment A: Technical Specifications (Including cover page)	259
Attachment B: Technical Drawings (Including cover page)	10
Attachment C: Asbestos Assessment – Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4 (Aug 15, 2023) (Including cover page)	68
TOTAL PAGES (AS ISSUED)	494
All other documents issued with this Request for Quotations that are not listed above	



INSTRUCTIONS TO BIDDERS

July 2025

TABLE OF CONTENTS

1. DEFINITIONS
2. ANY COMMUNICATIONS
3. REGISTERED PLAN TAKER
4. ELECTRONIC BID SUBMISSION ONLY
5. OMISSIONS, DISCREPANCIES AND INTERPRETATIONS IN REGION'S DOCUMENT (ADDENDUM)
6. WITHDRAWAL OR REVISION OF BIDS
7. PRE-BID MEETING, SITE VISIT AND SITE CONDITIONS
8. SCHEDULE OF PRICES & TOTAL BID PRICE
9. KEY CONSTRUCTION MILESTONES
10. ONTARIO HARMONIZED SALES TAX (HST)
11. BID SECURITY
12. PERFORMANCE SECURITY, LABOUR & MATERIAL SECURITY
13. VENDOR CODE OF CONDUCT
14. BID IRREGULARITIES
15. PRIVILEGE CLAUSE
16. TIED BIDS
17. CLAIMS OR LITIGATION
18. EXTENSION OF IRREVOCABILITY PERIOD
19. CONTRACT EXECUTION
20. VENDOR PERFORMANCE MANAGEMENT POLICY
21. SUBCONTRACTORS
22. ELECTRONIC PAYMENT DEPOSIT
23. PROPER INVOICE REQUIREMENTS
24. INTERIM ADJUDICATION
25. INTELLECTUAL PROPERTY
26. DIGITAL DRAWINGS
27. ONTARIANS REGULATION 191/11 – INTEGRATED ACCESSIBILITY STANDARDS
28. NON-RESIDENT WITHHOLDING TAX
29. FREEDOM OF INFORMATION
- APPENDIX “A”
- APPENDIX “B”
- APPENDIX “C”
- APPENDIX “D”

1. DEFINITIONS

“Act” means the Construction Act, R.S.O. 1990, CHAPTER C.30;

“Addendum” or “Addenda” means a change, addition or to respond to questions in relation to the Request for Tenders;

“Agreement” means the executed Agreement between the Region and the Contractor for the performance of the Work, included in Appendix “C” of the Instructions to Bidders;

“Award” means the award of a Contract by the Region to one (1) or more Bidders;

“Bid” means a Bidder submission offered in response to a procurement solicitation;

“Bidder” means a Vendor that submits a Bid;

“Bid Documents” means the documents included in this Request for Tender as listed in the Supplementary Instructions to Bidders, and any Addenda issued;

“Bid Security” means the security submitted by the Bidder with its Bid, which provides financial protection to the Region should the successful Bidder not enter into the Contract;

“Bidding System” or “Public Procurement Website” means the Region’s publicly accessible procurement website for issuing procurement solicitations and/or receiving Bids;

“Closing Date” and “Closing Time” means the deadline for submission of Bids as indicated in the Supplementary Instructions to Bidders;

“Construction” means any construction, reconstruction, demolition, repair or renovation of a building, structure, road or other engineering or architectural work;

“Contract” means the undertaking by the parties to perform their respective duties, responsibilities and obligations as prescribed in the Contract Documents and represents the entire Agreement between the Region and one (1) or more Contractors for the supply of Goods, Services and/or Construction, or a combination thereof;

“Contract Documents” consist of those documents listed in Article A-3 of the Agreement –
CONTRACT DOCUMENTS;

“Contract Price” means the amount stipulated in Article A-4 of the Agreement –
CONTRACT PRICE;

“Contractor” means the successful Bidder in respect of whose Bid an Award is made;

“Designated Sourcing Representative” means the Regional staff in Supply Chain Management responsible for the entire process until a Contract is Awarded by the Region;

“ECA” means the Electronic Commerce Act, 2000, S.O. 2000, c. 17;

“Goods” means material, furniture, merchandise, equipment, stationery and other supplies and goods, including any incidental services;

“HST” means taxes payable under the *Excise Tax Act*, R.S.C. 1985, c.E-15, or any tax that replaces HST;

“Irrevocability Period” means the duration in which the Bid shall remain irrevocable and open to Award by the Owner and is the duration indicated in the Supplementary Instructions to Bidders;

“Letter of Intent” means the letter sent by the Region to a Bidder following the Bid review period, indicating the Region’s intent to Award subject to Senior Management and/or Regional Council approval, the Bidder’s fulfilment of the requirements of the Request for Tender, and formal execution of the Agreement between the Bidder and the Region;

“Notice of Award Letter” means the letter sent by the Region to the successful Bidder confirming the Award of the Contract and will include direction to commence Work;

“Owner”, “Region”, “Halton” and “Halton Region” means The Regional Municipality of Halton;

“Plan Taker” means one who downloads documents associated with the bid opportunity via the Bidding System;

“Product” or “Products” means material, machinery, equipment, and fixtures forming part of the Work, but does not include Construction Equipment;

“Proper Invoice” means a Proper Invoice, submitted by the Contractor, as defined in section 6.1 of the Act and the Region’s Contract Documents;

“Ready-for-Takeover” shall have been attained when the conditions set out in paragraph 12.1.1 of GC 12.1 – READY-FOR-TAKEOVER have been met, as verified by the Consultant pursuant to paragraph 12.1.4.2 of GC 12.1 – READY-FOR-TAKEOVER;

“Request for Tenders” or “RFT” means a procurement solicitation that includes commercial terms with clearly defined scope of Goods, Services and/or Construction where cost is the primary evaluation criterion when making an Award;

“Schedule of Prices” means the schedule supplied as part of the Request for Tender for the purposes of inputting pricing for the Work, which shall be completed by the Bidder and submitted back to the Region in its entirety through the Bidding System. Any reference in the Contract Documents to Bid Form shall be deemed to refer to Schedule of Prices;

“Services” means a non-physical, intangible Product resulting from a Vendor’s performance that cannot be stored or transported and that comes into existence at the time it is bought or consumed;

“Specifications” means that portion of the Contract Documents, wherever located and whenever issued, consisting of the written requirements and standards for Products, systems, workmanship, quality, and the services necessary for the performance of the Work;

“Supplementary Instructions to Bidders” means amendments to the Instructions to Bidders, issued as a separate document, which describe instructions unique to the Region and/or a particular Project;

“Suspension” means that, for the specified duration of the Suspension, the Suspended Vendor will not be permitted to participate in any procurement solicitations, as a Vendor or subcontractor, including prequalification processes, issued by the Region and “Suspend” and “Suspended” have corresponding meaning;

“Total Bid Price” means the price stipulated in the Schedule of Prices in the Bidding System;

“Vendor” means any legal person or entity providing or interested in providing Goods, Services and/or Construction, including suppliers, contractors, consultants and other service providers;

“Vendor Code of Conduct” means the Region’s Vendor Code of Conduct as available on the Region’s website at www.halton.ca;

“Vendor Performance Management Policy” means the policy outlining the Region’s process for evaluating Vendor performance of Contracts and the consequences resulting from “Unacceptable” performance, as may be amended from time to time;

“Work” has the meaning indicated in the Contract Documents.

2. ANY COMMUNICATIONS

- 2.1 Any questions regarding this Request for Tenders are to be submitted in writing through Halton Region’s Public Procurement Website (<https://haltonregion.bidsandtenders.ca>) by using the “Submit a Question” link associated with this bid request. Questions or clarification requests received by telephone or e-mail will not be accepted. Questions are to be submitted no later than the date indicated in the Supplementary Instructions to Bidders.
- 2.2 The Region reserves the right to neither accept nor consider any questions received after 4:00 P.M on the date indicated on the Supplementary Instructions to Bidders. The Region will review all questions received and prepare a response that is made available as an Addendum, if necessary, to all Plan Takers.

- 2.3 It will be the Bidder's responsibility to clarify with the Region any questions arising from this Request for Tenders or any matter they consider unclear in accordance with this section before submitting their Bid. Under no circumstances shall Bidders rely upon any information or instructions from the Region, its employees, or its agents, unless the information or instructions are provided in writing in the form of an Addendum.
- 2.4 A Bidder or its representative(s) will only communicate with the Designated Sourcing Representative for the Bid. A Bidder or its representative(s) shall not communicate with any other Regional staff or elected officials from the time of issuance of this Request for Tenders until the final Award. The Region reserves the right to disqualify any Bidder who contravenes this prohibition.
- 2.5 A Bidder or its representative(s) shall not threaten, harass nor intimidate staff, elected officials or any other supplier from bidding on a Regional solicitation or performing a Regional Contract. The Region reserves the right to disqualify any Bidder who contravenes this prohibition.

3. REGISTERED PLAN TAKER

- 3.1 Bid documents are available online via the Bidding System at <https://haltonregion.bidsandtenders.ca>. A Vendor that subscribes to the Bidding System can login to their account to purchase and download the bid document(s) without the preview watermark. A Vendor that does not subscribe to the Bidding System may choose to purchase a one-time only download of this bid opportunity. Bid documents are only available via the Bidding System and will not be provided in any other format.
- 3.2 All Bidders shall have a Bidding System account and be registered as a Plan Taker for this bid opportunity, which will enable the Bidder to download the bid document without the watermark preview, to receive Addenda/Addendum email notifications, download Addenda and to submit their Bid electronically through the Bidding System. To ensure receipt of the latest information and updates via email regarding this bid, the onus is on the Bidder to create a Bidding System account and register as a Plan Taker for the bid opportunity.
- 3.3 Bidders must be registered as a Plan Taker for this bid opportunity on the Bidding System in order to submit a Bid. Should the Region receive a Bid that is subsequently found to be from a Bidder that is not a registered Plan Taker, the Region reserves the right to remove the Bid from further consideration.

4. ELECTRONIC BID SUBMISSION ONLY

- 4.1 Bids shall be submitted via the Bidding System no later than the Closing Date and Closing Time specified in the Supplementary Instructions to Bidders.
- 4.2 **Only Bids submitted via the Bidding System will be accepted.** Bids submitted by any other method or format will be automatically rejected. It is the sole

- responsibility of each Bidder to make sure that their Bid is delivered and received by the Bidding System by the Closing Date and Closing Time. Bids received after the specified Closing Date and Closing Time will not be accepted by the Bidding System.
- 4.3 There will not be a public Bid opening. When the Bids are opened, the unofficial bid results will be posted on the Bidding System at <https://haltonregion.bidsandtenders.ca> unless specified otherwise in the Bid Documents.
 - 4.4 Bidders are cautioned that the timing of their Bid submission is based on when the Bid is successfully received by the Bidding System, not when a Bid is submitted by a Bidder, as Bid transmission can be delayed for a number of reasons, including the file transfer size, transmission speed, etc.
 - 4.5 The Region shall not be liable for any costs, expenses, loss or damage resulting from any technical difficulty with the Bidding System, including, without limitation, computer system failures of either the Bidder or the Region's Bidding System service provider, a power failure, delays caused by internet/network traffic and/or failure of any computer system element.
 - 4.6 For the above reasons, the Region recommends that Bidders allow sufficient time to upload their Bid and attachment(s) (if applicable). The Closing Date and Closing Time shall be determined by the clock used by the Bidding System.
 - 4.7 The Region also encourages Bidders to take advantage of the Bidding System feature that allows Bidders to view their uploaded documents prior to submission of their Bid. Bidders are solely responsible for ensuring that they can access the Bidding System and submit their Bid before the Closing Date and Closing Time.
 - 4.8 The Bidding System will send a confirmation email to the Bidder advising that their Bid was submitted successfully. If you do not receive a confirmation email, contact technical support at Bids & Tenders via telephone at 1-800-594-4798 or email: support@bidsandtenders.ca.
- 5. OMISSIONS, DISCREPANCIES AND INTERPRETATIONS IN REGION'S DOCUMENT (ADDENDUM)**
- 5.1 Should a Bidder find omissions from or discrepancies in any Contract Documents or be in doubt as to the meaning or any part of the Contract Documents, the Bidder shall immediately notify the Region in writing.
 - 5.2 Through Addendum, the Manager, Strategic Sourcing may:
 - a) revise, delete, add to or substitute any part of the Bid Documents;
 - b) extend the Closing Date; or
 - c) provide a written explanation or interpretation of this Request for Tenders.

- 5.3 No oral explanation or interpretation by the Region shall modify any of the requirements or provisions of the Bid Documents.
- 5.4 Bidders are advised that Addenda will be posted at <https://haltonregion.bidsandtenders.ca> under the applicable bid call.
- 5.5 The Bidding System will attempt to notify each Plan Taker by email, of the issuance of an Addendum to the Bid Documents. The Bidding System will use the email address supplied by the Plan Taker at the time of purchase of the Bid Documents. The Region will not be responsible for missing or invalid email addresses.
- 5.6 It is the Bidder's responsibility to view and/or download all applicable Addenda prior to submitting a Bid. Addenda form part of the Bid Documents and must be taken into consideration when submitting a Bid.
- 5.7 Bidders shall acknowledge receipt of any Addenda when submitting their Bid through the Bidding System. Bidders shall check a box for each Addendum/Addenda and any applicable attachments that have been issued before a Bidder can submit their Bid.
- 5.8 It is the responsibility of the Bidder to ensure they have received all Addendum/Addenda that have been issued. Bidders should check online at <https://haltonregion.bidsandtenders.ca> prior to submitting their Bid to confirm all Addendum/Addenda have been received.
- 5.9 If a Bidder submits their Bid at any time prior to the Closing Date and Closing Time and an Addendum/Addenda is subsequently issued by the Region after the submission of the Bid, the Bidding System will automatically **WITHDRAW** the Bid submission and change the Bid submission to an **INCOMPLETE STATUS**. A Bid with an incomplete status will **NOT be accepted by the Region**. The withdrawn Bid can be viewed by the Bidder in the **"MY BIDS"** section of the Bidding System. The Bidder is solely responsible to:
- Make any required adjustments to their Bid;
 - Acknowledge the Addendum/Addenda; and
 - Ensure that the re-submitted Bid is successfully received by the Bidding System no later than the Closing Date and Closing Time.

6. **WITHDRAWAL OR REVISION OF BIDS**

- 6.1 Bidders may edit or withdraw their Bid submission through the Bidding System prior to the Closing Date and Closing Time. If the Bidder wishes to re-submit a Bid, the Bidder is solely responsible to:
- Make any required adjustments to their Bid;
 - Acknowledge the Addendum/Addenda; and

- c. Ensure the re-submitted Bid is successfully received by the Bidding System no later than the Closing Date and Closing Time.
- 6.2 Requests to withdraw Bids received by the Bidding System will not be considered after the Closing Date and Closing Time.

7. PRE-BID MEETING, SITE VISIT AND SITE CONDITIONS

- 7.1 Bidders are responsible to conduct any site examinations deemed necessary by the Bidder for the proper preparation of a Bid and/or to make themselves aware of all conditions that may affect the Work. Nothing in this Request for Tenders shall relieve the Bidders from undertaking all investigation and clarification on all matters related to this Request for Tenders. No allowance will be made for additional costs nor will any claim be considered in connection with conditions or circumstances that could have been reasonably ascertained by the Bidders had reasonable efforts been made prior to the Closing Date and Closing Time.
- 7.2 If a pre-bid meeting and site visit is required, details will be provided in the Supplementary Instructions to Bidders.
- 7.3 General Instructions for pre-bid meetings and site visits:
 - 7.3.1 The site meeting will begin promptly at the designated time. Bidders are encouraged to arrive prior to the time indicated in order to sign in.
 - 7.3.2 Attendees will be provided with an overview of the project. It is the responsibility of each Bidder to conduct a sufficient investigation of the site(s) and of the Work and obtain all required information about local conditions to be met with during the Work prior to submitting their Bid. The Bidders shall make their own estimates and measurements of the facilities and difficulties that may be encountered. Bidders may not claim at any time after submission of the Bid that there was any misunderstanding of the terms and conditions of the Contract relating to site conditions evident or apparent during the Bid period.
 - 7.3.3 The Region will not be held responsible for a Bidder's failure to obtain such information in section 7.3.2. The Region assumes no responsibility and will not pay additional costs for any omissions in the bid submission as a result of site-specific conditions that Bidders could have seen if they visited the site(s).
 - 7.3.4 It is the responsibility of the Bidder to verify actual site conditions and measurements. The price submitted is for the completed Work, including all items which may not have been mentioned but are required to complete the scope of Work.
- 7.4 Mandatory Site Meeting Instructions (where applicable):

7.4.1 Where there is a mandatory site meeting(s), Bidders who fail to attend and register their attendance at the mandatory site meeting(s) will be disqualified from submitting a Bid.

7.4.2 At the Region's discretion, a Bidder that arrives late to the mandatory site meeting(s) may be disqualified from submitting a Bid.

7.5 Non- Mandatory Site Meeting Instructions (where applicable):

7.5.1 Where there is a non-mandatory site meeting(s), Bidders are not required to attend the site meeting(s) in order to submit a Bid. However, the Region strongly recommends that Bidders attend the site meeting(s) in order to familiarize themselves with the existing conditions prior to submitting their Bid.

8. SCHEDULE OF PRICES & TOTAL BID PRICE

8.1 Bidders shall complete and submit the Schedule of Prices through the Bidding System.

8.2 The Total Bid Price shall be in Canadian Dollars and shall include the furnishing of all materials, supplies and equipment and the provision of all labour, construction tools and equipment, utility and transportation services necessary to perform and complete all the Work required under the Contract, including all miscellaneous Work, whether specifically included in the Contract Documents or not. Goods and Services rendered will be billed to actual expenses, in accordance with the rates as Bid.

8.3 The Total Bid Price does not include HST.

8.4 It is the intention of the Contract Documents to provide finished Work. Any items omitted therefrom which are clearly necessary for the completion of the Work or its appurtenances shall be considered a portion of the Work though not directly specified and/or shown or called for in the Contract Documents and shall be included in the Total Bid Price.

8.5 Failure to complete any part of the Schedule of Prices or to provide all requested information may result in a Bid being declared non-compliant.

9. KEY CONSTRUCTION MILESTONES

9.1 Refer to the Supplementary Instructions to Bidders for key construction milestones including the commence work date, the Ready-for-Takeover date, and the completion date.

10. ONTARIO HARMONIZED SALES TAX (HST)

- 10.1 The Contractor will be required to provide the Region with its HST registration number and indicate the applicable HST on each progress payment certificate.

11. BID SECURITY

- 11.1 Bidders shall upload to the Bidding System the following: Bid Security in the amount of no less than **5 (five) percent of the Total Bid Price plus HST** in the following form:

11.1.1 A **digital bid bond** in an electronically verifiable and enforceable (e-Bond) format, in the form CCDC 220 – 2024 naming “The Regional Municipality of Halton” as obligee and issued by a surety licensed to conduct surety and insurance business in Canada or in Ontario, in the amount set out in Section 11.1. **The digital bid bond form is included in Appendix “A” to this Instructions to Bidders.**

11.1.2 The version submitted by the Bidder must be verifiable by the Region with respect to the totality and wholeness of the bond form, including: the content; all digital signatures; all digital seals; with the surety, or an approved verification service provider of the surety.

11.1.3 The version submitted must be viewable, printable and storable in standard electronic file formats compatible with the Region, and in a single file. Allowable formats include pdf.

11.1.4 The verification may be conducted by the Region immediately or at any time during the life of the bond and at the discretion of the Region with no requirement for passwords or fees.

11.1.5 The results of the verification must provide a clear, immediate and printable indication of pass or fail regarding Item 11.1.2.

- 11.2 A scanned PDF copy of bonds, original certified cheque, bank draft, money order or any other format other than a digital bid bond is not acceptable and shall be rejected.

- 11.3 A digital bid bond failing the verification process will NOT be considered to be valid.

- 11.4 A digital bid bond passing the verification process will be treated as original and authentic.

- 11.5 Bidders shall upload their Bid Security to the Bidding System, labelled as **“Digital Bid Bond”**. All instructions and details for assessing authentication shall be included with the digital bid bond uploaded in the Bidding System.

- 11.6 The digital bid bond will not be returned to the Bidder.

- 11.7 The Bid Security shall be valid and not expire for at least the duration of the Irrevocability Period. In the event the Irrevocability Period is extended in accordance with section 18 of the Instructions to Bidders, the Bidder shall secure from its surety an extension of the Bid Security and provide evidence of same, which may be in the form of a rider to the Bid Security or some other form of written communication from the surety.

12. PERFORMANCE SECURITY, LABOUR & MATERIAL SECURITY

Agreement to Bond

- 12.1 Bidders shall upload to the Bidding System evidence that if awarded the Contract the Bidder will provide the **performance bond** required by the Contract. Such evidence shall be in the following form:

12.1.1 Where the Total Bid Price is equal to or greater than \$500,000 a **digital agreement to bond** in an electronically verifiable and enforceable (e-Bond) format issued by a surety licensed to conduct surety and insurance business in Canada or in Ontario for a **performance bond** in the Form 32 Performance Bond under section 85.1 of the Act, in the amount of fifty percent (50%) of the Total Bid Price (plus HST). The agreement to bond shall remain valid and not expire for at least the duration of the Irrevocability Period. In the event the Irrevocability Period is extended in accordance with section 18 of the Instructions to Bidders (the “Extended Irrevocability Period”), the Bidder shall secure from its surety an extension of the agreement to bond and provide evidence of same, which may be in the form of a rider to the agreement to bond or some other form of written communication from the surety. **The digital agreement to bond form is included in Appendix “B” to this Instructions to Bidders.**

- 12.2 Bidders shall upload to the Bidding System evidence that if awarded the Contract the Bidder will provide the **labour & material payment bond** required by the Contract. Such evidence shall be in the following form:

12.2.1 Where the Total Bid Price is equal to or greater than \$500,000, a **digital agreement to bond** in an electronically verifiable and enforceable (e-Bond) format issued by a surety licensed to conduct surety and insurance business in Canada or in Ontario for a **labour & material payment bond** in the Form 31 Labour and Material Payment Bond under section 85.1 of the Act, in the amount of fifty percent (50%) of the Total Bid Price (plus HST). The agreement to bond shall remain valid and not expire for at least the duration of the Irrevocability Period. In the event the Irrevocability Period is extended in accordance with section 18 of the Instructions to Bidders (the “Extended Irrevocability Period”), the Bidder shall secure from its surety an extension of the agreement to bond and provide evidence of same, which may be in the form of a rider to the agreement to bond or some other form of written communication from the surety. **The**

digital agreement to bond form is included in Appendix “B” to this Instructions to Bidders.

- 12.3 Bidders shall upload the digital Agreement to Bond described in sections 12.1 and 12.2 of the Instructions to Bidders (collectively the “**Digital Agreement to Bond Performance Security and Labour & Material Security**”) to the Bidding System, labelled as “**Digital Agreement to Bond**”. All instructions and details for assessing authentication shall be included with the digital agreement to bond uploaded in the Bidding System.

Agreement to Bond Requirements

- 12.4 The Digital Agreement to Bond Performance Security and Labour & Material Security shall be in the form as provided in Appendix “B” and shall include an express acknowledgement from the surety that a digitally signed and sealed performance bond and a digitally signed and sealed labour & material payment bond delivered to the Region by electronic means are:
- 12.4.1 permitted under the ECA;
 - 12.4.2 binding on the surety;
 - 12.4.3 enforceable in accordance with their terms and enforceable in law;
 - 12.4.4 for the purposes of any applicable statutory or common laws, regulations or guidelines, deemed to be originals hand delivered to the Region; and
 - 12.4.5 on the basis of the forgoing, the surety acknowledges and agrees that it would be estopped from and covenant not to challenge the enforceability of the bonds on the basis that each are digitally signed and sealed and delivered to the Region by electronic means.
- 12.5 The version submitted by the Bidder must be verifiable by the Region with respect to the totality and wholeness of the Digital Agreement to Bond Performance Security and Labour & Material Security form, including: the content; all digital signatures; all digital seals; with the surety, or an approved verification service provider of the surety.
- 12.6 The version submitted must be viewable, printable and storable in standard electronic file formats compatible with the Region, and in a single file. Allowable formats include pdf.
- 12.7 The verification may be conducted by the Region immediately or at any time during the life of the Digital Agreement to Bond Performance Security and Labour & Material Security and at the discretion of the Region with no requirement for passwords or fees.
- 12.8 The results of the verification must provide a clear, immediate and printable indication of pass or fail regarding Item 12.5.
- 12.9 A scanned PDF copy of an agreement to bond, or any other format other than a digital agreement to bond is not acceptable and shall be rejected.

- 12.10 An agreement to bond failing the verification process will NOT be considered to be valid.
- 12.11 An agreement to bond passing the verification process will be treated as original and authentic.
- 12.12 The Digital Agreement to Bond Performance Security, Labour & Material Security will not be returned to the Bidder.

Performance and Labour & Material Payment Bonds

- 12.13 Where the Contract Price is equal to or greater than \$500,000, prior to the execution of the Contract, the accepted Bidder will be required to provide a Form 32 Performance Bond, under section 85.1 of the Act, in the amount of fifty percent (50%) of the Total Bid Price (including HST) (“**Performance Bond**”), and a Form 31 Labour and Material Payment Bond under section 85.1 of the Act in the amount of fifty percent (50%) of the Total Bid Price (including HST) (“**Labour & Material Bond**”) to guarantee the faithful performance of the Contract.
- 12.14 The Performance Bond and Labour & Material Payment Bond shall be submitted to the Region in one of the following forms:
 - 12.14.1 Certified originals, issued in triplicate; or
 - 12.14.2 An electronically verifiable and enforceable (e-Bond) format issued by a surety licensed to conduct surety and insurance business in Canada or in Ontario, that meets the requirements as outlined in sections 12.16 of the Instructions to Bidders.
- 12.15 The Performance Bond and Labour and Material Payment Bond shall be in the prescribed form under the Act, using the current version of the form. The necessary information will be inputted into the forms after Bid closing and sent to the selected Bidder with the Letter of Intent. Changes to the prescribed forms under the Act will not be accepted.

Digital Performance Bond and Labour and Material Payment Bond Requirements

- 12.16 The Performance Bond and Labour and Material Payment Bond issued in an electronically verifiable and enforceable (e-Bond) format in accordance with Section 12.14.2 shall be delivered by email transmission to the Regional Project Manager and shall satisfy and be subject to the following requirements:
 - 12.16.1 The version submitted by the selected Bidder must be verifiable by the Region with respect to the totality and wholeness of the Performance Bond and Labour & Material Payment Bond, including: the content; all digital signatures; all digital seals; with the surety, or an approved verification service provider of the surety.

12.16.2 The version submitted by the selected Bidder must be viewable, printable and storable in standard electronic file formats compatible with the Region, and in a single file. Allowable formats include pdf.

12.16.3 The verification may be conducted by the Region immediately or at any time during the life of the Performance Bond and Labour & Material Payment Bond and at the discretion of the Region with no requirement for passwords or fees.

12.16.4 The results of the verification must provide a clear, immediate and printable indication of pass or fail regarding Section 12.16.1.

12.16.5 A scanned PDF copy of Performance Bond and Labour & Material Payment Bond or any other format other than the formats provided for in Sections 12.14.1 and 12.14.2 are not acceptable and shall be rejected.

12.16.6 A Performance Bond and Labour & Material Payment Bond failing the verification process will NOT be considered to be valid.

12.16.7 A Performance Bond and Labour & Material Payment Bond passing the verification process will be treated as original and authentic.

13. VENDOR CODE OF CONDUCT

13.1 The Vendor Code of Conduct, as included in the Bid Documents, sets out the principles applicable to Vendors that wish to establish and maintain a business relationship with the Region.

13.2 The Region intends to do business with Bidders that demonstrate solid business integrity that aligns with the Region's core values and high standards of ethical behaviour expected by the Region. The Vendor Code is not to be read in lieu of, but in addition to obligations as set out in any agreements with the Region. Bidders are responsible to familiarize themselves with the Vendor Code of Conduct and comply with it. Bidders are to complete, sign and return the Vendor Code of Conduct Acknowledgement Form with their Bid submission.

14. BID IRREGULARITIES

14.1 Irregularities in connection with any Bid shall be resolved in accordance with Regional policies and procedures governing bid irregularities.

15. PRIVILEGE CLAUSE

15.1 The Region shall have the right to reject any or all Bids. The Bid with the lowest Total Bid Price will not necessarily be accepted. The Region reserves the right to accept all or part of any Bid.

15.2 The Manager, Strategic Sourcing may cancel the Request for Tenders at their sole discretion.

- 15.3 In addition to any other right expressed or implied, the Region reserves the right to:
- a) make public the names of any or all Bidders and members of a Bidder's team;
 - b) check references other than those provided by any Bidder;
 - c) disqualify or invalidate any Bid that contains material misrepresentations or any other materially inaccurate or misleading information;
 - d) make changes, including substantial changes, to this Request for Tenders provided that those changes are issued by way of Addenda;
 - e) if a single Bid is received, reject the Bid of the sole Bidder and cancel this Request for Tenders process or enter into direct negotiations with the sole Bidder.
- 15.4 The Region shall not be responsible for any liabilities, costs, expenses, loss or damage incurred, sustained or suffered by any Bidder by reason of the acceptance or the non-acceptance of the Bid, delay in Awarding the Contract, or cancellation of the Request for Tenders.
- 15.5 The Region, in its sole discretion, may reject a Bid from a Suspended Vendor and/or a Bid that includes a Suspended Vendor as a sub-contractor, in accordance with the Vendor Performance Management Policy.

16. TIED BIDS

- 16.1 In the event that two or more Bidders have exactly the same Total Bid Price, the Region shall have the sole right to select the successful Bid. The Region may, at its sole option, conduct a coin toss in the presence of the two (2) Bidders to select the successful Bid. The Region shall determine the manner and rules that shall govern the coin toss.

17. CLAIMS OR LITIGATION

- 17.1 The Region reserves the right, and in its absolute discretion after considering the criteria outlined in subsection 17.2, to reject a Bid submitted by a Bidder if the Region is engaged in legal action dispute including but not limited to a contractual claim and/or legal action against the Bidder, or, if the Bidder or any officer or director of the Bidder is engaged, either directly or indirectly through a corporation or personally, in a legal action dispute, including but not limited to a contractual claim and/or legal action against the Region, its elected representatives, appointed officers, or employees, in relation to:
- a. any other Contract, Goods or Services;
 - b. any matter arising from the Region's exercise of its powers, duties, or functions.
- 17.2 In determining whether or not to reject a Bid the Region will consider;

- a. whether the litigation is likely to adversely affect the Bidder's ability to work with the Region, its consultants and representatives; or,
- b. whether the Region's experience with the Bidder indicates that the Region is likely to incur increased staff and legal costs in the administration of the Contract if it is Awarded to the Bidder; or,
- c. whether the Bidder has been convicted of a criminal act against the Region or one of its local boards or corporations; or,
- d. whether the Bidder has failed to satisfy an outstanding debt to the Region, including Provincial Offences Act fines, or one of its local boards or corporations; or,
- e. whether there are reasonable grounds to believe it would not be in the best interests of the Region to enter into a Contract with the Bidder.

18. EXTENSION OF IRREVOCABILITY PERIOD

- 18.1 In the event the Region is unable to Award the Bid within the Irrevocability Period as set out in the Supplementary Instructions to Bidders, the Region shall request a formal extension in writing from one or more Bidders.
- 18.2 Subject to agreement by the Bidder(s) in writing, the Irrevocability Period shall be extended and the Bid Documents shall be considered automatically amended to reflect the revised Irrevocability Period.

19. CONTRACT EXECUTION

- 19.1 Where the Contract Price is more than \$250,000 (excluding HST), the Agreement to be executed by the parties shall be in the form provided in Appendix "C" to this Instructions to Bidders. This Agreement is a template only; the necessary information will be inserted into the Agreement after Bid closing and provided to the selected Bidder. Where the Contract Price is equal to or less than \$250,000 (excluding HST) the selected Bidder shall execute the Notice of Award. A Letter of Intent and the Contract Documents will be sent to the selected Bidder. The Bidder shall fully execute and return the Contract Documents together with the applicable Bonds (if required), Certificates of Liability Insurance, Workplace Safety and Insurance, New/Change Vendor & Electronic Funds Transfer Application (if required), and any other required documents to the Region within ten (10) calendar days of the date of receipt of the Letter of Intent, failing which the Region reserves the right to retain the Bidder's Bid Security and not Award to the Bidder. The aforementioned documents shall be completed to the satisfaction of the Region with no errors and omissions.
- 19.2 The Letter of Intent does not constitute Award of the Contract. Award is subject to Senior Management and/or Regional Council approval, the Bidder's fulfilment of the requirements of the Request for Tenders, such as the submission of the required documentation as set out in the Letter of Intent, which may include but is

not limited to those items referenced in section 19.1, and formal execution of the Agreement or Notice of Award between the Bidder and the Region.

- 19.3 In the event the Region, in its sole discretion, allows an extension of time for the Bidder to submit the required documentation referenced in section 19.1, the Bidder shall not be entitled to an extension of Contract time or delay claims as a result of the Bidder's delay in submitting completed documentation.

20. VENDOR PERFORMANCE MANAGEMENT POLICY

- 20.1 Bidders shall refer to the Supplementary Instructions to Bidders to confirm the applicability of the Vendor Performance Management Policy (the "Policy") to the Contract upon Award.

- 20.2 If the Policy applies to the Awarded Contract:

- a) The Region will evaluate the Contractor's performance in accordance with the Policy and provide a written evaluation and record of the Contractor's performance of this Contract. The Contractor will be provided with regular feedback of its performance of a Contract, to confirm satisfactory or unacceptable performance as applicable, and the consequences of unacceptable performance as outlined in the Policy.
- b) The Policy may be amended from time to time, and the latest version of the Policy shall form part of this Contract.
- c) The Policy and the applicable evaluation form can be accessed on the Region's website at www.halton.ca.

21. SUBCONTRACTORS

- 21.1 Bidders must ensure they and any subcontractors they retain are in good standing with the Region, in accordance with the Policy. It is the responsibility of Bidders to review the Suspended Vendor List on www.halton.ca prior to submitting a Bid or retaining any subcontractors.

22. ELECTRONIC PAYMENT DEPOSIT

- 22.1 The Region strongly encourages payment to the Contractor through electronic payment deposit. The successful Bidder(s) is to provide the New/Change Vendor & Electronic Funds Transfer Application Form as part of the documentation required prior to Award. Bidders are not to include the form with their Bid submission.
- 22.2 If during the Contract term, there is any change to the direct deposit information, the Contractor shall submit a new form, which must be authorized by a signing officer, and a person with the ability to bind the corporation. The Region will

verify any and all changes to the banking information with the Contractor prior to making any changes.

23. PROPER INVOICE REQUIREMENTS

- 23.1 The Contractor will be required to comply with the prompt payment provisions pursuant to Part I.1 of the Act and the Proper Invoice requirements set out in the Region's Contract Documents.

24. INTERIM ADJUDICATION

- 24.1 The Contractor will be required to comply with the construction dispute interim adjudication provisions pursuant to Part II.1 of the Act and the Region's Contract Documents.

25. INTELLECTUAL PROPERTY

- 25.1 All reports, plans, designs, and other documents to be produced by the Contractor to this Request for Tenders shall, on submission to the Region, become the property of the Region.

26. DIGITAL DRAWINGS

- 26.1 Should a Bidder choose to print any of the drawings supplied by the Region in a PDF format, to preserve the scale of the prints, the Bidder must disable all page scaling options during printing. The Region assumes no responsibility whatsoever for the Bidder's failure to properly print, including the failure to print to the proper scale, any drawings supplied by the Region.
- 26.2 It is the Bidder's sole responsibility to verify that all PDF drawings are printed without PDF scaling enabled by verifying the final PDF prints with the associated drawing scale references in the applicable drawings title block.

27. ONTARIANS REGULATION 191/11 – INTEGRATED ACCESSIBILITY STANDARDS

- 27.1 Pursuant to *Ontario Regulation 191/11* under the *Accessibility for Ontarians with Disabilities Act, 2005*, the Region is required to incorporate accessibility design, criteria and features when procuring or acquiring goods, services or facilities, except where it is not practicable to do so.
- 27.2 When determining which bid will result in an Award the Region may, in its sole discretion and without limiting any of its other express or implied rights regarding

the discretion to make an Award, consider whether the Goods, Services or facilities to be provided incorporate accessibility design, criteria and features.

28. NON-RESIDENT WITHHOLDING TAX

- 28.1 Should the Region make an Award to a non-resident Vendor, the Region shall under the *Income Tax Act*, R.S.C., 1985, c. 1 (5th Supp.), and the Income Tax Regulations, C.R.C., c.945, all as amended from time to time, withhold 15% (fifteen percent) from payments of fees, commissions, or other amounts paid to non-resident Vendors, in respect of Services rendered in Canada, in accordance with the above, for Services rendered in Canada. The Region is not required to withhold this amount under subsection 105(1) of the Regulations, if the non-resident Vendor obtains a waiver certificate from the Canada Revenue Agency prior to the commencement of the Contract.

29. FREEDOM OF INFORMATION

- 29.1 The information provided in response to this Request for Tenders is collected in accordance with the Region's Purchasing By-law No. 63-23, or as amended, and will be used for all purposes related to awarding the Bid and administering By-law No. 63-23. The Bidder acknowledges that the Region is subject to the Municipal Freedom of Information and Protection of Privacy Act, R.S.O 1990, c.M.25, as amended ("MFIPPA") and as a result the contents of any Bid submitted by the Bidder are public and that with the exception of personal information the Bid will be disclosed if the Region receives a request for it under MFIPPA.

APPENDIX “A”

BID BOND

Canadian Construction
Documents Committee

CCDC 220 – 2024 'BID BOND'

No.

Bond Amount \$.....

..... as principal, hereinafter called
the Principal, and a corporation
duly authorized to transact the business of Suretyship in as surety, hereinafter called the
Surety, are held and firmly bound unto
as obligee, hereinafter called the Obligor, in the amount of
Dollars (\$)) lawful money of Canada, for the
payment of which sum the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and
assigns, jointly and severally.

WHEREAS, the Principal has submitted a written bid to the Obligor, for (Name, Location or Address, and Project Number,
if any):

The condition of this obligation is such that if the Principal shall have the bid accepted within the Validity Period and:

- a) Enters into a formal contract; and,
- b) Gives such bond or bonds as may be specified in the Obligor's bid documents from a Surety duly authorized to
transact the business of Suretyship in the jurisdiction of the project,

then this obligation shall be void. Otherwise, provided the Obligor takes all reasonable steps to mitigate the amount of such
excess costs, the Principal and the Surety will pay to the Obligor the difference in money between the amount of the bid of
the Principal and the amount for which the Obligor legally contracts with another party for the work, supplies and services
which were specified in the said bid, if the latter amount be in excess of the former.

The "Validity Period" as used herein shall mean the time period prescribed in the Obligor's bid documents for acceptance
of the bid, or, if no time period is specified in the Obligor's bid documents, sixty (60) calendar days from the closing date of
the bid.

By agreement between the Principal and the Obligor, the Validity Period may be extended by up to sixty (60) calendar days
without notice to the Surety. Further or longer extensions of the Validity Period require prior consent of the Surety.

The Principal and Surety shall not be liable for a greater sum than the Bond Amount.

It is a condition of this bond that any suit or action must be commenced within seven (7) months of the date of this Bond. In
the province of Québec, the coverage period of this bond expires seven (7) months after the date of this Bond.

No right of action shall accrue hereunder to or for the use of any person or corporation other than the Obligor named
herein, or the heirs, executors, administrators or successors of the Obligor.

The Surety:

.....
(corporate name)
.....
(address)
.....
(fax)
.....
(email)

The Obligor:

.....
(proper name)
.....
(address)
.....
(fax)
.....
(email)

The Principal:

.....
(corporate name)
.....
(address)
.....
(fax)
.....
(email)

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond dated day of
in the year

SIGNED and SEALED
in the presence of

ATTORNEY IN FACT

Principal

Signature

(name of person signing)

Surety

Signature

(name of person signing)

APPENDIX “B”**AGREEMENT TO BOND**

We, the undersigned, hereby agree to become bound as Surety for _____ (hereinafter referred to as the Bidder) for a Performance Bond totalling fifty percent (50%) of the Total Bid Price (including HST) and for a Labour & Material Payment Bond totalling fifty per cent (50%) of the Total Bid Price (including HST) all conforming to the Contract Documents, for the full and due performance of the work shown as described therein and for the payment of all labour and materials and maintenance, if the Bid for the construction of

is accepted by The Regional Municipality of Halton.

It is a condition of this Agreement to Bond that if the above-mentioned Bid is accepted, the undersigned will supply the above-specified bonds within ten (10) days from the day upon which notification of selection of the Bid is given.

This Agreement to Bond shall remain valid for the duration of the Irrevocability Period as set out in the Supplementary Instructions to Bidders.

The surety acknowledges that a digitally signed and sealed Performance Bond and Labour & Material Bond delivered to the Region by electronic means are:

- i. permitted under the *Electronic Commerce Act, 2000*, S.O. 2000, c. 17;
- ii. binding on the surety;
- iii. enforceable in accordance with the surety's terms and enforceable in law;
- iv. for the purposes of any applicable statutory or common laws, regulations or guidelines, deemed to be originals hand delivered to the Region; and
- v. on the basis of the forgoing, the surety acknowledges and agrees that it would be estopped from and covenants not to challenge the enforceability of the bonds on the basis that each are digitally signed and sealed and delivered to the Region by electronic means.

DATED this ____ day of _____, 20

Name of Surety Company

Signature of Authorized Person Signing for Company

(Company Seal)

Title

NOTE: Surety must be licensed to conduct surety and insurance business in Canada or in Ontario, satisfactory to the Region in its reasonable discretion.

APPENDIX "C"

AGREEMENT BETWEEN OWNER AND CONTRACTOR

AGREEMENT BETWEEN OWNER AND CONTRACTOR

For use when a stipulated price is the basis of payment.

This Agreement made on _____ day of _____ in the year _____
by and between the parties

hereinafter called the "Owner"

and

hereinafter called the "Contractor"

The Owner and the Contractor agree as follows:

ARTICLE A-1 THE WORK

The Contractor shall:

- 1.1 perform the Work required by the Contract Documents for (insert below the description or title of the Work)

located at (insert below the Place of the Work)

for which the Agreement has been signed by the parties, and for which (insert below the name of the Consultant)

is acting as and is hereinafter called the "Consultant" and

- 1.2 do and fulfill everything indicated by the Contract Documents, and
- 1.3 commence the Work by the _____ day of _____ in the year _____ and, subject to adjustment in Contract Time as provided for in the Contract Documents, attain Ready-for-Takeover, by the _____ day of _____ in the year _____.

ARTICLE A-2 AGREEMENTS AND AMENDMENTS

- 2.1 The Contract supersedes all prior negotiations, representations or agreements, either written or oral, relating in any manner to the Work, including the bid documents that are not expressly listed in Article A-3 of the Agreement – CONTRACT DOCUMENTS.
- 2.2 The Contract may be amended only as provided in the Contract Documents.

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1

ARTICLE A-3 CONTRACT DOCUMENTS

3.1 The following are the *Contract Documents* referred to in Article A-1 of the Agreement – THE WORK:

- Agreement between *Owner* and *Contractor*
- Definitions
- General Conditions

*

** (Insert here, attaching additional pages if required, a list identifying all other Contract Documents e.g. supplementary conditions; Division 01 of the Specifications – GENERAL REQUIREMENTS; Project information that the Contractor may rely upon; technical Specifications, giving a list of contents with section numbers and titles, number of pages and date; material finishing schedules; Drawings, giving drawing number, title, date, revision date or mark; addenda, giving title, number, date; time schedule)*

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2

ARTICLE A-4 CONTRACT PRICE

4.1 The *Contract Price*, which excludes *Value Added Taxes*, is:

_____/100 dollars \$ _____

4.2 *Value Added Taxes* (of _____ %) payable by the *Owner* to the *Contractor* are:

_____/100 dollars \$ _____

4.3 Total amount payable by the *Owner* to the *Contractor* for the *Work* is:

_____/100 dollars \$ _____

4.4 These amounts shall be subject to adjustments as provided in the *Contract Documents*.

4.5 All amounts are in Canadian funds.

ARTICLE A-5 PAYMENT

5.1 Subject to the provisions of the *Contract Documents* and *Payment Legislation*, and in accordance with legislation and statutory regulations respecting holdback percentages, the *Owner* shall:

- 1 make progress payments to the *Contractor* on account of the *Contract Price* when due in the amount certified by the *Consultant* unless otherwise prescribed by *Payment Legislation* together with such *Value Added Taxes* as may be applicable to such payments,
- 2 upon *Substantial Performance of the Work*, pay to the *Contractor* the unpaid balance of the holdback amount when due together with such *Value Added Taxes* as may be applicable to such payment, and
- 3 upon the issuance of the final certificate for payment, pay to the *Contractor* the unpaid balance of the *Contract Price* when due together with such *Value Added Taxes* as may be applicable to such payment.

5.2 Interest

- 1 Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by adjudication, arbitration or court, interest at the following rates on such unpaid amounts shall also become due and payable until payment:
 - (1) 2% per annum above the prime rate for the first 60 days.
 - (2) 4% per annum above the prime rate after the first 60 days.
 Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interest quoted by
 (Insert name of chartered lending institution whose prime rate is to be used)

_____ for prime business loans as it may change from time to time.

- 2 Interest shall apply at the rate and in the manner prescribed by paragraph 5.2.1 of this Article on the settlement amount of any claim in dispute that is resolved either pursuant to Part 8 of the General Conditions – DISPUTE RESOLUTION or otherwise, from the date the amount would have been due and payable under the *Contract*, had it not been in dispute, until the date it is paid.

ARTICLE A-6 RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING

6.1 *Notices in Writing* will be addressed to the recipient at the address set out below.

6.2 The delivery of a *Notice in Writing* will be by hand, by courier, by prepaid first class mail, or by other form of electronic communication during the transmission of which no indication of failure of receipt is communicated to the sender.

6.3 A *Notice in Writing* delivered by one party in accordance with this *Contract* will be deemed to have been received by the other party on the date of delivery if delivered by hand or courier, or if sent by mail it will be deemed to have been received five calendar days after the date on which it was mailed, provided that if either such day is not a *Working Day*, then the *Notice in Writing* will be deemed to have been received on the *Working Day* next following such day.

6.4 A *Notice in Writing* sent by any form of electronic communication will be deemed to have been received on the date of its transmission provided that if such day is not a *Working Day* or if it is received after the end of normal business hours on the date of its transmission at the place of receipt, then it will be deemed to have been received at the opening of business at the place of receipt on the first *Working Day* next following the transmission thereof.

6.5 An address for a party may be changed by *Notice in Writing* to the other party setting out the new address in accordance with this Article.

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3

In witness whereof the parties hereto have executed this Agreement by the hands of their duly authorized representatives.

SIGNED AND DELIVERED
in the presence of:

WITNESS

signature

name of person signing

OWNER

name of Owner

signature

name and title of person signing

WITNESS

signature

name of person signing

CONTRACTOR

name of Contractor

signature

name and title of person signing

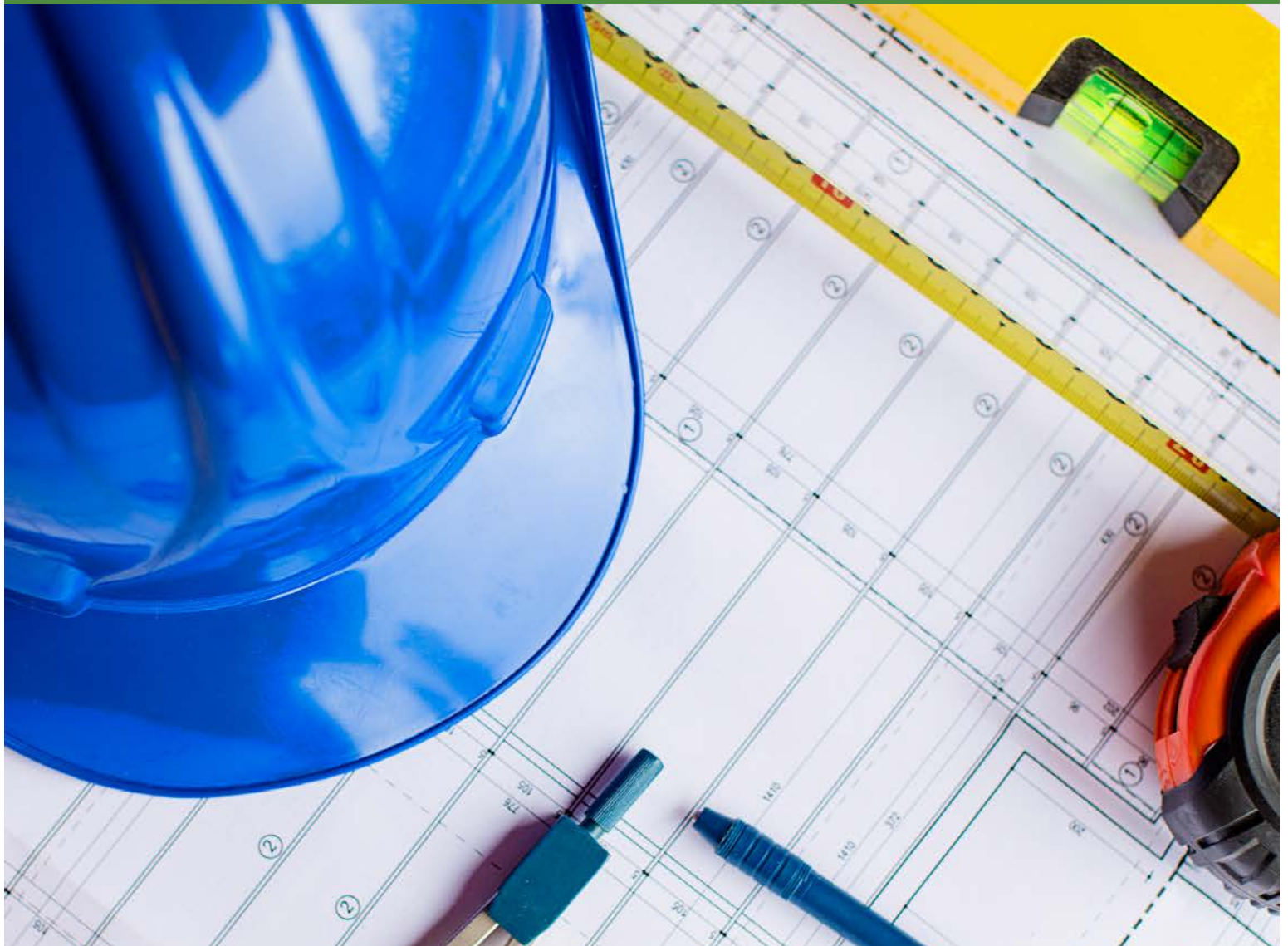
- N.B.** Where legal jurisdiction, local practice or Owner or Contractor requirement calls for:
- (a) proof of authority to execute this document, attach such proof of authority in the form of a certified copy of a resolution naming the representative(s) authorized to sign the Agreement for and on behalf of the corporation or partnership; or
 - (b) the affixing of a corporate seal, this Agreement should be properly sealed.

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APPENDIX “D”

VENDOR CODE OF CONDUCT



HALTON REGION Vendor Code of Conduct



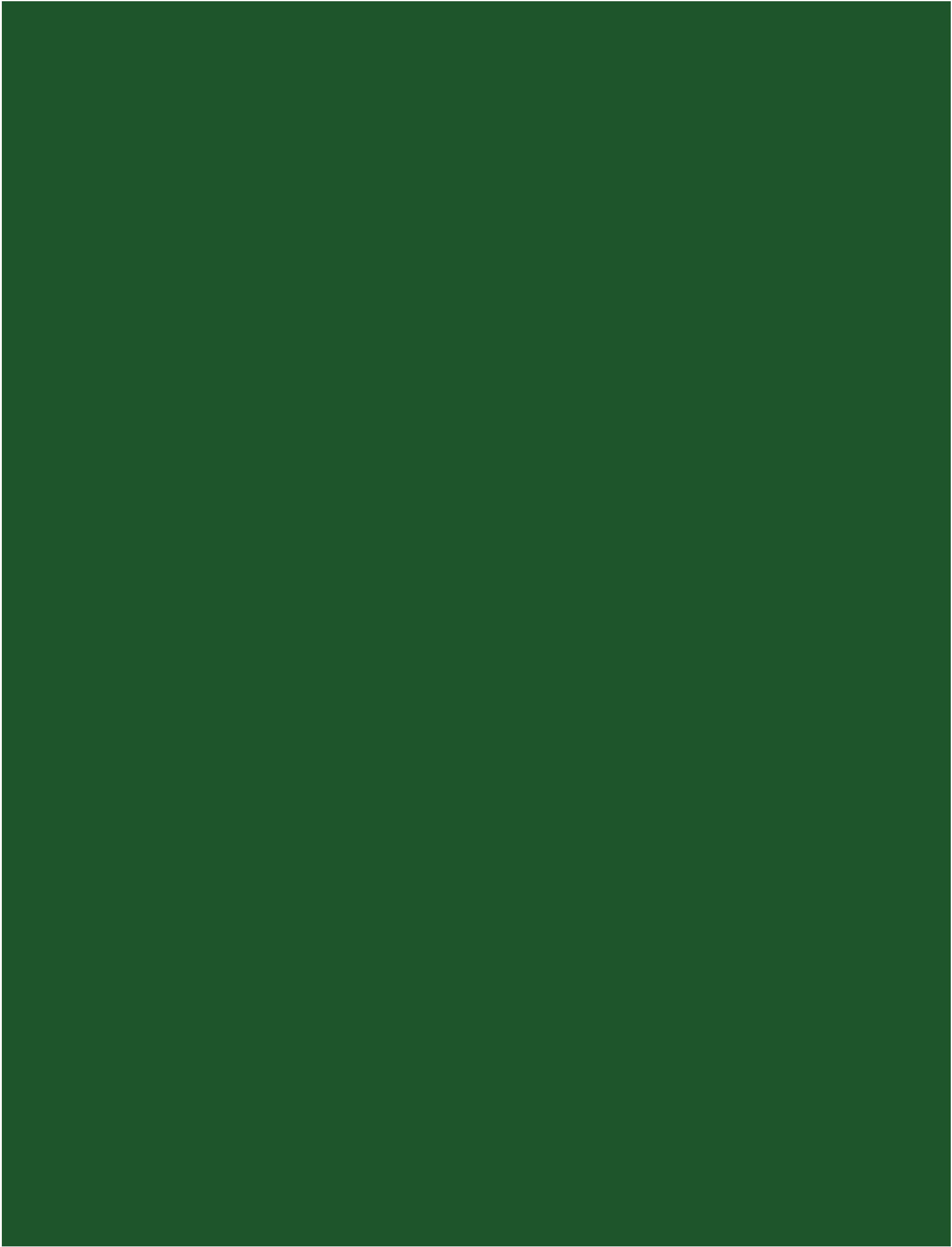
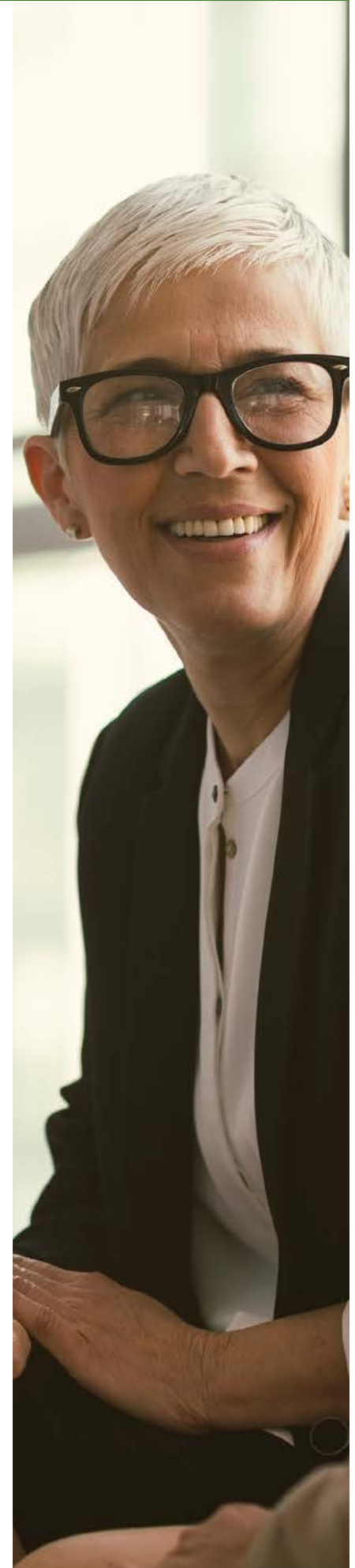
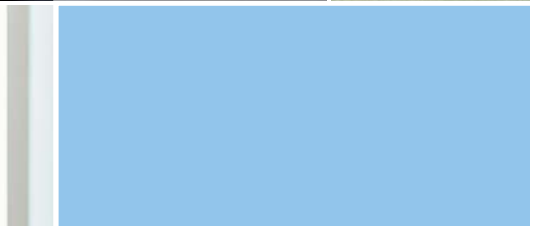
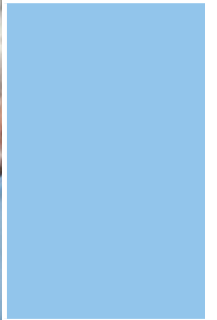
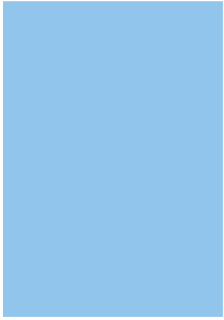
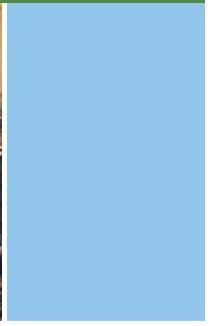
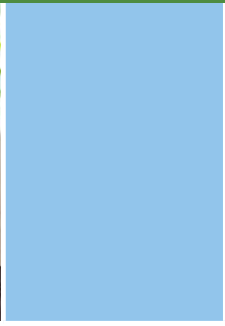


Table of Contents

Introduction and Purpose	5
Vendor Responsibilities	6
i. Compliance with Laws	7
ii. Confidentiality and Privacy	8
iii. Information Security	8
iv. Social Media	9
Integrity and Public Confidence	10
i. Conflict of Interest	10
ii. Business and Personal Relationships	11
iii. Avoidance of Preferential Treatment	11
iv. Gifts and Hospitality	11
v. Political Activity	12
vi. Fraud	12
vii. Theft and Vandalism	12
viii. Anti-Bribery and Anti-Corruption	13
ix. Collusive Bidding	13
Workplace Well-being	14
i. Respectful Workplace	14
ii. Accessibility for People with Disabilities	14
iii. Employment Practices	14
iv. Impairment at Work	15
Non-Compliance Reporting	16
i. Complaint Resolution Procedure	17
ii. Alternative Reporting – Confidential Code of Conduct Help Line	18
Penalty for Non-Compliance	19
Acknowledgement Form	20





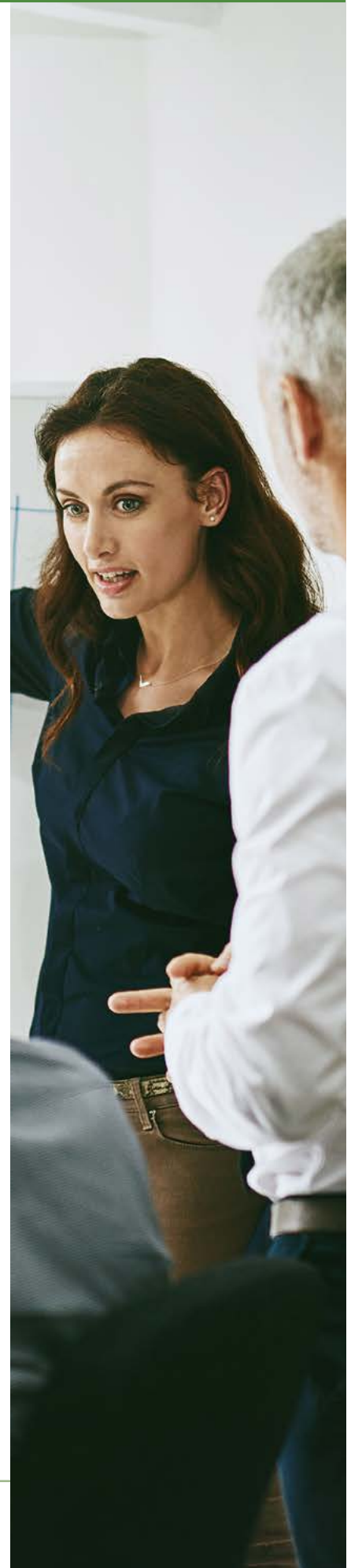
Introduction and Purpose

The Regional Municipality of Halton (herein after referred to as “The Region”) is committed to purchasing goods and services from responsible Vendors that provide quality goods and services at competitive prices. Vendors, subcontractors, employees, agents, bidders and potential bidders that provide goods and services to the Region (herein after referred to as “Vendors”) are expected to support the Region’s goals and objectives of encouraging competitive bidding, ensuring fairness, accountability and transparency in the procurement process, and obtaining the best possible value in the procurement of goods and services for the Region.

The Region expects Vendors to perform all duties in a competent and impartial manner that can withstand the closest public scrutiny. Vendors are expected to exercise good judgement when doing business with the Region. This Vendor Code of Conduct (herein after referred to as “Vendor Code”) sets out the principles applicable to Vendors that wish to establish and maintain a business relationship with the Region. The Region is confirming its intention to do business with Vendors that demonstrate solid business integrity that aligns with the Region’s core values and high standards of ethical behaviour. Vendors must also inform their employees and any sub-contractors or sub-vendors about this Vendor Code.

The Vendor Code is consistent with Halton Region’s Code of Conduct, which sets out the expectations for Regional staff. The Region’s Code of Conduct is available on the Region’s website.

The Vendor Code should not be read in lieu of, but in addition, to Vendors obligations as set out in any agreements between the Region and a Vendor. In the event of a conflict between this Code and an applicable agreement, the agreement shall govern.





Vendor Responsibilities

Vendors are required to familiarize themselves with this Vendor Code and comply with it as a condition of doing business with the Region. Vendors are expected to adhere to the following core principles of business integrity:

- a) uphold the laws of the Region, Ontario and Canada, and not be a party to their breach, evasion or subversion;
- b) treat all persons honestly and fairly, with proper regard for rights, entitlements, duties and obligations, and at all times act responsibly and diligently in the performance of their duties;
- c) be professional and courteous, and resolve any work-related disagreements in a responsible and expeditious manner;
- d) be accountable and responsible for their decisions and actions, take ownership of problems and initiate corrective actions;
- e) promote the health and safety of others and prevent workplace illness, injury, harassment and violence;
- f) carry out their duties in a fair, impartial and transparent manner;
- g) complete the Acknowledgment Form as set out in Appendix A; and
- h) report on non-compliance or suspected non-compliance of the Vendor Code.

These principles are also consistent with the Halton Region Code of Conduct.

i. Compliance with Laws

Vendors that wish to do business with the Region shall abide by all applicable laws and regulations including Federal, Provincial and Local laws regarding environmental matters, occupational health and safety, labour and employment practices, human rights, accessibility, immigration, product safety, shipping and product labelling. If Vendors become aware of any activities that are not in compliance with all applicable laws and regulations, they must report it immediately as specified in the non-compliance reporting section of this Vendor Code.

Vendors shall disclose:

- 1) any previous convictions of collusion, bribery, fraud or other similar practices prohibited under law for which they have not received a pardon; and
- 2) breach of the Region's Vendor Code or those of any other related Agencies or Corporation(s) of the Region.

Vendors are prohibited from misrepresenting their relevant past experiences and qualifications in relation to any solicitation process and acknowledge that the Region's process of evaluation may include information provided by the Vendor's references as well as records of past performance on previous contracts and services with the Region. The Region reserves its rights if the Vendor fails to make the appropriate disclosures and representations.





ii. Confidentiality and Privacy

Vendors may have access to confidential and/or personal information by reason of their duties and responsibilities with the Region. Confidential information is defined as any information that is proprietary, strategic, technical, business or personal and not available to the public. All Vendors must respect such information and ensure it is safeguarded from unauthorized disclosure or access. Confidential information must be protected in accordance with the Vendor Code of Conduct. Such information must only be used or disclosed in accordance with this Vendor Code of Conduct and the provisions of the *Municipal Freedom of Information and Protection of Privacy Act, 1990* and the *Personal Health Information Protection Act, 2004*.

Disclosure of information means making the information available to others, and should only occur where disclosure is necessary and proper in the discharge of the Region's functions or where the disclosure is required by law. This includes and protects any information that is, and should be considered as, internal information relating to Regional business.

Vendors must not disclose confidential and/or personal information unless specifically and explicitly permitted in the terms of their contract. The duty of a Vendor to maintain the integrity and confidentiality of Regional information continues once that Vendor ceases to be in a contract with the Region.

When discussing business matters, Vendors must consider their surroundings. Conversations in public places should be limited to information that is non-confidential and does not include references that could identify a person or situation.

iii. Information Security

Vendors must use information obtained through their relationship with the Region only for the purposes of the supply relationship. Vendors must store information securely and have in place appropriate information security policies and procedures. Vendors must notify the Region promptly of actual or suspected privacy breaches, security breaches or loss of Regional information.

iv. Social Media

The Region supports the use of online communications to enhance customer service and leverage the Region's brand. Vendors should not communicate on social media platforms on behalf of the Region unless the Vendor is expressly authorized in writing to do so by the Region. When such communication is authorized, it is to be conducted in a manner that is consistent and respectful of Canadian libel laws, *Municipal Freedom of Information and Protection of Privacy Act, 1990* and the Region's practices in regards to confidential information and intellectual property.

All Regional data or information obtained by the Vendor through the delivery of services or goods is to be considered proprietary and confidential. Without the Region's prior consent, Vendors should not communicate to social media platforms identifying the Region as a client and the associated services and goods provided to the Region. Regional consent must be obtained prior to identifying the Region as a client.





Integrity and Public Confidence

i. Conflict of Interest

Public confidence in the Region is put at risk when the conduct of a Vendor involves or appears to involve a conflict between public duty and private interests. Vendors are required to support and advance the interests of the Region and avoid placing themselves in situations where their personal interests actually or potentially conflict with the interests of the Region. Vendors shall disclose to the Region any situation that could result in an actual, apparent or perceived conflict of interest and the Regional employee that has an interest in the Vendor's business (or any other economic or family ties with the Vendor).

Vendors are expected, at minimum, to:

- a) base business decisions strictly on merit and the best interests of the Region in a manner consistent with their contractual obligations with the Region;
- b) avoid any situation that may create a real or perceived conflict of interest;
- c) not take part in, or in any way influence, any Regional decision that might result in a financial or other advantage, whether direct or indirect, as a result of the contractual association with the Region;
- d) not attempt to gain an improper advantage or preferential treatment from Regional employees; and
- e) provide no personal benefit to employees of the Region.

If Vendors become aware of any activities that may be considered a conflict of interest involving the Region, they must report it immediately as specified in the non-compliance reporting section of this Vendor Code.

ii. Business and Personal Relationships

Vendors shall not use or seek to use their association with the Region to receive direct or indirect benefit for themselves or their family members, friends and any other businesses or consultants that they or the Region do business with.

iii. Avoidance of Preferential Treatment

Vendors shall not grant preferential treatment to any Regional staff, their family and friends, or any businesses. Vendors must avoid creating or appear to create an obligation for the purpose of gaining any special consideration.

iv. Gifts and Hospitality

Accepting a gift, hospitality or other benefit from a Vendor could influence an employee's judgment and performance of official duties, or give the appearance of doing so, even if the employee believes the benefit will not affect their objectivity or impartiality. Vendors must not offer, directly or indirectly, any gift, hospitality or other benefits to the Region's staff. Gifts having a monetary value such as cash, gift certificates, loans, services, discounts and ticket(s) to an entertainment event including sporting events, concerts or other such related activities must not be offered. These requirements do not change during traditional gift-giving seasons.

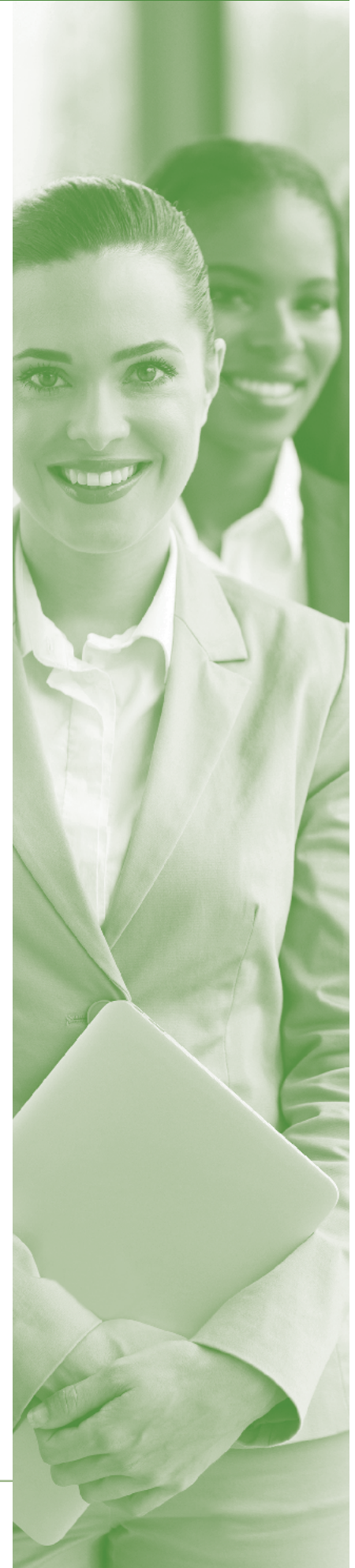
Under no circumstances should a Vendor solicit gifts, hospitality and/or other benefits or transfers of economic value to Region staff. The same is expected of the Region staff—not to solicit gifts or other benefits from Vendors.

All Regional staff are subject to the rules governing the acceptance of gifts as outlined in Section 26.2.1 of Halton Region Purchasing By-law No. 63-23 and the Halton Region Code of Conduct.

Employees may accept common expressions of courtesy that do not cause suspicion about the objectivity and impartiality of the employee, would not compromise the integrity of the Region and:

- a) are of a nominal value not to exceed fifty (\$50);
- b) occur on infrequent and exceptional basis; and
- c) are not ticket(s) to an entertainment event including sporting events, concerts, or other such related activities.

Vendors must not place Regional employees in the difficult position of having to refuse gifts that would place them in conflict with the rules governing the acceptance of gifts outlined in this Vendor Code.



v. Political Activity

No Vendor shall engage in political activity on Regional property while carrying out the requirements of their contract for the Region. If Vendors become aware of any political activities, they must report it immediately as specified in the non-compliance reporting section of this Vendor Code.

vi. Fraud

The Region is committed to the highest standards of corporate accountability, transparency, responsibility and integrity. The Region will protect funds, property, information and other assets owned by or in the care of the Region through the prompt investigation of any alleged fraudulent conduct.

Vendors must not engage in any fraudulent activity. Examples of activities which may be considered fraudulent include, but are not limited to:

- a. forgery or alteration of documents (cheques, purchase orders, time sheets, etc.);
- b. misappropriation of funds, securities, supplies or assets;
- c. authorization or receipt of payment for goods not received, services not performed or hours not worked;
- d. any claim for reimbursement of expenses that were not incurred for the exclusive benefit of the Region;
- e. authorization of unjustified or inflated change order requests to increase profits;
- f. knowingly delivering works, goods or services that do not meet contract specification; and
- g. subcontracting to business entities that are not arm's length without prior consent of the Region.

If Regional Vendors, their employees, associates or other third parties become aware of any activities that may be considered fraudulent, they must report it immediately as specified in the non-compliance reporting section of this Vendor Code.

vii. Theft and Vandalism

The Region's assets must be protected from theft, destruction, vandalism and neglect, and used properly and strictly for the Region's purposes. Vendors' personal use, misuse, misappropriation of/or theft or vandalism of Regional property, resources, equipment, materials and supplies is prohibited.

viii. Anti-Bribery and Anti-Corruption

Vendors are expected to comply with applicable anti-corruption laws, whether domestic or foreign, including but not limited to the *Corruption of Foreign Public Officials Act, 1998* and the Criminal Code, and not engage in any form of corrupt practices including, but not limited to, extortion, fraud, bribery or other unlawful payment or benefit to secure any concession, contract or other favourable treatment.

Vendors should not engage in any conduct that would put the Region at risk of violating anti-bribery laws or regulations. Bribery is the giving or receiving of a “thing” of value to influence the actions of another person or organization.

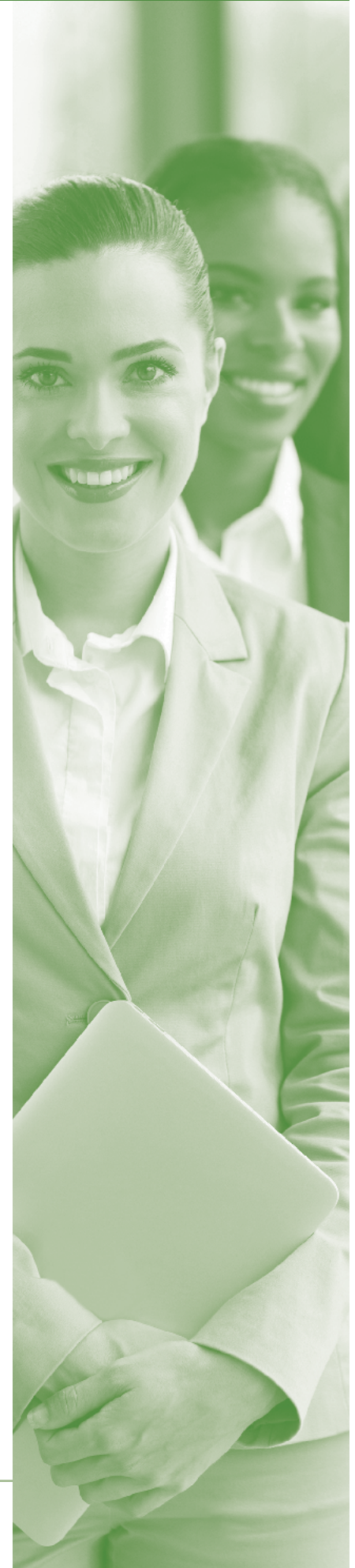
Types of bribery can include, but are not limited to:

- a) kickback payments that could be received before, during or at the end of a project/contract; and
- b) any financial benefits given with the intent of influencing the recipient which includes such things as gifts (for example, travel or entertainment), loans, credit cards, purchase overpayments, cash, fees and commissions.

ix. Collusive Bidding

Vendors are not to participate in collusive bidding. Groups of bidders might secretly agree to submit complementary high bids to allow pre-selected Vendors to win contracts on a rotating basis, divide contracts by territory or take steps to defeat the competitive process and divide work. Vendors are not to contract with separate business entities that are not arm’s length, submit a bid through non arm’s length entity or reveal confidential information to an arm’s-length or non-arm’s length entity.

If Vendors, their employees, associates or other third parties become aware of any activities that may be considered bribery or collusive bidding, they must report it immediately as specified in the non-compliance reporting section of this Vendor Code.



A man with short dark hair and a light beard, wearing a blue button-down shirt, is looking down at a white tablet he is holding in his hands. He has a slight smile on his face.

Workplace Well-being

i. Respectful Workplace

The Region is committed to protecting the health and safety of all Regional employees and Vendors against illness, injury and incidents of violence and harassment. Every Vendor will make every effort to provide and maintain a safe and healthy work environment, as well as maintain a diverse and respectful workplace in which the dignity and self-respect of every person is valued.

Vendors must ensure that their personal conduct within the workplace and elsewhere does not adversely affect:

- a) their ability to perform their official duties;
- b) the ability of other Vendors to perform their duties; or
- c) public confidence in the Region or in the public sector.

ii. Accessibility for People with Disabilities

Vendors are required to have met compliance obligations in the *Accessibility for Ontarians with Disabilities Act, 2005* and Ontario Regulation 191/11-Integrated Accessibility Standards, as applicable.

iii. Employment Practices

Vendors must abide by applicable employment standards, labour, non-discrimination and human rights legislation. Where laws do not prohibit discrimination or where they allow for differential treatment, Vendors are expected to be committed to non-discrimination principles and operate in a way that does not differentiate unfairly.

iv. Impairment at Work

In order to minimize the risk of impaired performance due to substance use, the following are strictly prohibited for all Regional Vendors:

- use, possession, distribution, offering or sale of illegal drugs, illegal drug paraphernalia or un-prescribed drugs (for which a prescription is legally required in Canada) while on Regional business or premises;
- use, possession, distribution, offering or sale of alcoholic beverages or cannabis on Regional premises;
- intentional misuse of prescribed medications, over-the-counter medications or other substances while on Regional business or premises; and
- being unfit for work due to the effects or after-effects of alcohol, illicit or illegal drugs, un-prescribed drugs (for which a prescription is legally required in Canada) or the intentional misuse of medications or other substances.

Vendors are required to report to their Regional supervisor or project authority the use of any medication that may affect their ability to perform their job in a safe manner. Vendors have a responsibility to manage potential impairments during working hours due to the legitimate use of medications in consultation with their personal physician.

If Vendors, their employees, associates or other third parties become aware of any activities that may be considered impaired performance due to substance use, they must report it immediately as specified in the non-compliance reporting section of this Vendor Code.





Non-Compliance Reporting

Vendors must report any practices, behaviours, activities or actions believed to be in contravention or in conflict with this Vendor Code, Halton Region Code of Conduct or any other Regional policy.

The Region will resolve all complaints regarding violations of this Vendor Code to the greatest extent possible in a timely, respectful and confidential manner, and ensure all Vendors are held accountable for their actions.

All Vendors shall be free from reprisal, discipline, harassment or discrimination as a result of reporting, in good faith, a breach or suspected breach of this Vendor Code. If it is determined, however, that a complaint is frivolous, vexatious or malicious in nature, the complainant may be subject to action as outlined in the Penalty for Non-Compliance section of this Vendor Code.

During the investigation and resolution of complaints, all information, including the identity of the complainant and any other Vendors or Vendor staff involved, will remain confidential except where sharing information is otherwise required by law or required to further the investigation.

i. Complaint Resolution Procedure

EARLY RESOLUTION

Vendors who become aware of or have directly experienced an action which is in contravention of this Vendor Code should:

- a) keep a written record of the incidents, dates, time, locations, possible witnesses, any attempted resolutions and behaviours of the Vendor(s) involved; and
- b) report the breach to the Director of Supply Chain Management, who must investigate and attempt to resolve the complaint as expeditiously as possible, except in the case of suspected fraud, which is to be immediately reported to the Chief Internal Auditor as specified in the Formal Complaint Investigation section of this Vendor Code.

The Regional Municipality of Halton

Director of Supply Chain Management
1151 Bronte Road
Oakville ON L6M 3L1
905-825-6000 ext. 7231
Sam.Pringle@halton.ca

If the Director of Supply Chain Management is not able to resolve the complaint to the reporting Vendor's satisfaction, and/or the complaint involves the Director of Supply Chain Management, a complaint shall be filed directly to the Region's Chief Internal Auditor or to the Code of Conduct Help Line.

FORMAL COMPLAINT INVESTIGATION

- a) Complaints must be made in writing and signed by the complainant using a designated form. The form is available on the Region's website.
- b) Complaints must be forwarded to the Chief Internal Auditor, who will initiate an investigation into the complaint within five (5) business days of receipt.

The Regional Municipality of Halton

Chief Internal Auditor
1151 Bronte Road
Oakville ON L6M 3L1
905-825-6000 ext. 7532
Karen.Cinq-Mars@halton.ca

- c) Once the investigation is complete, the investigation findings and recommendations will be reported to the complainant and respondent, as appropriate and as determined by the Chief Internal Auditor.





ii. **Alternative Reporting – Confidential Code of Conduct Help Line**

A Vendor who does not feel comfortable reporting a complaint as outlined above may contact the Region's confidential and anonymous Vendor Code of Conduct Help Line (available 24/7) at:

- Toll-free telephone: 1-833-210-0001
 - Website: www.lighthouse-services.com/haltonvendor
 - Email: reports@lighthouse-services.com (must include Halton Region in the subject line)
- a) All complaints submitted to the Vendor Code of Conduct Help Line will be received by a third party who will relay the complaint, without revealing the caller's identity (if requested), to the Chief Administrative Officer.
 - b) The confidential complaint will be reviewed by the Chief Administrative Officer and the Director of Human Resources within five (5) business days of the initial review.
 - c) Once the investigation is complete, the investigation findings and recommendations will be reported to the complainant and respondent, as appropriate, if their identities are made known.

The Region does not guarantee that an investigation will be conducted for every complaint.

Penalty for Non-Compliance

Any vendor who contravenes the Vendor Code, including any provision of this Vendor Code, may be subject to:

- a) verbal or written warning;
- b) cancellation of business relationship and/or contract;
- c) disqualification from participating in future business opportunities; and/or
- d) such other action or penalty as may be appropriate and permitted by law in the circumstances of the particular contravention.

This Vendor Code may be modified from time to time by the Region at its discretion.



Acknowledgement Form

The attached Vendor Code of Conduct sets forth the principles required by the Regional Municipality of Halton ("the Region") of all Vendors who supply goods and services to the Region when conducting business with the Region.

By signing this Acknowledgement, the undersigned Vendor agrees to abide by the Vendor Code of Conduct and also agree to ensure its employees, officers, agents, representatives, and subcontractors are also made aware of and comply with it.

ACKNOWLEDGEMENT

I, _____ an authorized representative of _____, hereby acknowledge and agree to abide by the attached Vendor Code of Conduct, and will ensure that the employees, officers, agents, representatives and subcontractors of _____ are aware of and abide by such policies and principles in the process of preparing and submitting bids and proposals for Regional work, provisions of goods and services to the Region, and during the performance of all agreements entered into with the Region for such purposes.

Submitted by:
(Please type/print)

Business Name

Signature of Signing Officer

Street Address

Name and Title (please print)

City/Town

Postal Code

Signature of Contact Person

Telephone Number

Fax Number

Name and Title (please print)

Contact Email Address

Date





CCDC 2

Stipulated Price Contract

2 0 2 0

Heat Pump Upgrade at 540 Plains Road E., Burlington, ON

Apply a CCDC 2 copyright seal here. The application of the seal demonstrates the intention of the party proposing the use of this document that it be an accurate and unamended form of CCDC 2 – 2020 except to the extent that any alterations, additions or modifications are set forth in supplementary conditions.

CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE
CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE
CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE

CCDC 2 STIPULATED PRICE CONTRACT

TABLE OF CONTENTS

AGREEMENT BETWEEN OWNER AND CONTRACTOR

- A-1 The Work
- A-2 Agreements and Amendments
- A-3 Contract Documents
- A-4 Contract Price
- A-5 Payment
- A-6 Receipt of and Addresses for Notices in Writing
- A-7 Language of the Contract
- A-8 Succession

DEFINITIONS

- Change Directive
- Change Order
- Construction Equipment
- Consultant
- Contract
- Contract Documents
- Contract Price
- Contract Time
- Contractor
- Drawings
- Notice in Writing
- Owner
- Other Contractor
- Payment Legislation
- Place of the Work
- Product
- Project
- Ready-for-Takeover
- Shop Drawings
- Specifications
- Subcontractor
- Substantial Performance of the Work
- Supplemental Instruction
- Supplier
- Temporary Work
- Value Added Taxes
- Work
- Working Day

GENERAL CONDITIONS

PART 1 GENERAL PROVISIONS

- GC 1.1 Contract Documents
- GC 1.2 Law of the Contract
- GC 1.3 Rights and Remedies
- GC 1.4 Assignment

PART 2 ADMINISTRATION OF THE CONTRACT

- GC 2.1 Authority of the Consultant
- GC 2.2 Role of the Consultant
- GC 2.3 Review and Inspection of the Work
- GC 2.4 Defective Work

PART 3 EXECUTION OF THE WORK

- GC 3.1 Control of the Work
- GC 3.2 Construction by the Owner or Other Contractors
- GC 3.3 Temporary Work
- GC 3.4 Construction Schedule
- GC 3.5 Supervision
- GC 3.6 Subcontractors and Suppliers
- GC 3.7 Labour and Products
- GC 3.8 Shop Drawings

PART 4 ALLOWANCES

- GC 4.1 Cash Allowances
- GC 4.2 Contingency Allowance

PART 5 PAYMENT

- GC 5.1 Financing Information Required of the Owner
- GC 5.2 Applications for Payment
- GC 5.3 Payment
- GC 5.4 Substantial Performance of the Work and Payment of Holdback
- GC 5.5 Final Payment
- GC 5.6 Deferred Work
- GC 5.7 Non-conforming Work

PART 6 CHANGES IN THE WORK

- GC 6.1 Owner's Right to Make Changes
- GC 6.2 Change Order
- GC 6.3 Change Directive
- GC 6.4 Concealed or Unknown Conditions
- GC 6.5 Delays
- GC 6.6 Claims for a Change in Contract Price

PART 7 DEFAULT NOTICE

- GC 7.1 Owner's Right to Perform the Work, Terminate the Contractor's Right to Continue with the Work or Terminate the Contract
- GC 7.2 Contractor's Right to Suspend the Work or Terminate the Contract

PART 8 DISPUTE RESOLUTION

- GC 8.1 Authority of the Consultant
- GC 8.2 Adjudication
- GC 8.3 Negotiation, Mediation and Arbitration
- GC 8.4 Retention of Rights

PART 9 PROTECTION OF PERSONS AND PROPERTY

- GC 9.1 Protection of Work and Property
- GC 9.2 Toxic and Hazardous Substances
- GC 9.3 Artifacts and Fossils
- GC 9.4 Construction Safety
- GC 9.5 Mould

PART 10 GOVERNING REGULATIONS

- GC 10.1 Taxes and Duties
- GC 10.2 Laws, Notices, Permits, and Fees
- GC 10.3 Patent Fees
- GC 10.4 Workers' Compensation

PART 11 INSURANCE

- GC 11.1 Insurance

PART 12 OWNER TAKEOVER

- GC 12.1 Ready-for-Takeover
- GC 12.2 Early Occupancy by the Owner
- GC 12.3 Warranty

PART 13 INDEMNIFICATION AND WAIVER

- GC 13.1 Indemnification
- GC 13.2 Waiver of Claims

CCDC 2 is the product of a consensus-building process aimed at balancing the interests of all parties on the construction project. It reflects recommended industry practices. The CCDC and its constituent member organizations do not accept any responsibility or liability for loss or damage which may be suffered as a result of the use or interpretation of CCDC 2.

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AGREEMENT BETWEEN OWNER AND CONTRACTOR

For use when a stipulated price is the basis of payment.

This Agreement made on _____ day of _____ in the year _____.
by and between the parties

hereinafter called the "*Owner*"

and

hereinafter called the "*Contractor*"

The *Owner* and the *Contractor* agree as follows:

ARTICLE A-1 THE WORK

The *Contractor* shall:

- 1.1 perform the *Work* required by the *Contract Documents* for *(insert below the description or title of the Work)*

located at *(insert below the Place of the Work)*

for which the Agreement has been signed by the parties, and for which *(insert below the name of the Consultant)*

is acting as and is hereinafter called the "*Consultant*" and

- 1.2 do and fulfill everything indicated by the *Contract Documents*, and

- 1.3 commence the *Work* by the _____ day of _____ in the year _____ and, subject to adjustment in *Contract Time* as provided for in the *Contract Documents*, attain *Ready-for-Takeover*, by the _____ day of _____ in the year _____.

ARTICLE A-2 AGREEMENTS AND AMENDMENTS

- 2.1 The *Contract* supersedes all prior negotiations, representations or agreements, either written or oral, relating in any manner to the *Work*, including the bid documents that are not expressly listed in Article A-3 of the Agreement – CONTRACT DOCUMENTS.

- 2.2 The *Contract* may be amended only as provided in the *Contract Documents*.

ARTICLE A-3 CONTRACT DOCUMENTS

3.1 The following are the *Contract Documents* referred to in Article A-1 of the Agreement – THE WORK:

- Agreement between *Owner* and *Contractor*
- Definitions
- General Conditions

*

** (Insert here, attaching additional pages if required, a list identifying all other Contract Documents e.g. supplementary conditions; Division 01 of the Specifications – GENERAL REQUIREMENTS; Project information that the Contractor may rely upon; technical Specifications, giving a list of contents with section numbers and titles, number of pages and date; material finishing schedules; Drawings, giving drawing number, title, date, revision date or mark; addenda, giving title, number, date; time schedule)*

ARTICLE A-4 CONTRACT PRICE

4.1 The *Contract Price*, which excludes *Value Added Taxes*, is:

/100 dollars \$

4.2 *Value Added Taxes* (of _____ %) payable by the *Owner* to the *Contractor* are:

/100 dollars \$

4.3 Total amount payable by the *Owner* to the *Contractor* for the *Work* is:

/100 dollars \$

4.4 These amounts shall be subject to adjustments as provided in the *Contract Documents*.

4.5 All amounts are in Canadian funds.

ARTICLE A-5 PAYMENT

5.1 Subject to the provisions of the *Contract Documents* and *Payment Legislation*, and in accordance with legislation and statutory regulations respecting holdback percentages, the *Owner* shall:

- .1 make progress payments to the *Contractor* on account of the *Contract Price* when due in the amount certified by the *Consultant* unless otherwise prescribed by *Payment Legislation* together with such *Value Added Taxes* as may be applicable to such payments,
- .2 upon *Substantial Performance of the Work*, pay to the *Contractor* the unpaid balance of the holdback amount when due together with such *Value Added Taxes* as may be applicable to such payment, and
- .3 upon the issuance of the final certificate for payment, pay to the *Contractor* the unpaid balance of the *Contract Price* when due together with such *Value Added Taxes* as may be applicable to such payment.

5.2 Interest

- .1 Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by adjudication, arbitration or court, interest at the following rates on such unpaid amounts shall also become due and payable until payment:
 - (1) 2% per annum above the prime rate for the first 60 days.
 - (2) 4% per annum above the prime rate after the first 60 days.

Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interest quoted by
(Insert name of chartered lending institution whose prime rate is to be used)

for prime business loans as it may change from time to time.

- .2 Interest shall apply at the rate and in the manner prescribed by paragraph 5.2.1 of this Article on the settlement amount of any claim in dispute that is resolved either pursuant to Part 8 of the General Conditions – DISPUTE RESOLUTION or otherwise, from the date the amount would have been due and payable under the *Contract*, had it not been in dispute, until the date it is paid.

ARTICLE A-6 RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING

6.1 *Notices in Writing* will be addressed to the recipient at the address set out below.

6.2 The delivery of a *Notice in Writing* will be by hand, by courier, by prepaid first class mail, or by other form of electronic communication during the transmission of which no indication of failure of receipt is communicated to the sender.

6.3 A *Notice in Writing* delivered by one party in accordance with this *Contract* will be deemed to have been received by the other party on the date of delivery if delivered by hand or courier, or if sent by mail it will be deemed to have been received five calendar days after the date on which it was mailed, provided that if either such day is not a *Working Day*, then the *Notice in Writing* will be deemed to have been received on the *Working Day* next following such day.

6.4 A *Notice in Writing* sent by any form of electronic communication will be deemed to have been received on the date of its transmission provided that if such day is not a *Working Day* or if it is received after the end of normal business hours on the date of its transmission at the place of receipt, then it will be deemed to have been received at the opening of business at the place of receipt on the first *Working Day* next following the transmission thereof.

6.5 An address for a party may be changed by *Notice in Writing* to the other party setting out the new address in accordance with this Article.

Owner*name of Owner***address**email address***Contractor***name of Contractor***address**email address***Consultant***name of Consultant***address**email address*** If it is intended that a specific individual must receive the notice, that individual's name shall be indicated.***ARTICLE A-7 LANGUAGE OF THE CONTRACT**

- 7.1 When the *Contract Documents* are prepared in both the English and French languages, it is agreed that in the event of any apparent discrepancy between the English and French versions, the English / French # language shall prevail.
Complete this statement by striking out inapplicable term.
- 7.2 This Agreement is drawn in English at the request of the parties hereto. La présente convention est rédigée en anglais à la demande des parties.

ARTICLE A-8 SUCCESSION

- 8.1 The *Contract* shall enure to the benefit of and be binding upon the parties hereto, their respective heirs, legal representatives, successors, and assigns.

In witness whereof the parties hereto have executed this Agreement by the hands of their duly authorized representatives.

SIGNED AND DELIVERED
in the presence of:

WITNESS

OWNER

name of Owner

signature

signature

name of person signing

name and title of person signing

WITNESS

CONTRACTOR

name of Contractor

signature

signature

name of person signing

name and title of person signing

- N.B. Where legal jurisdiction, local practice or Owner or Contractor requirement calls for:*
- (a) proof of authority to execute this document, attach such proof of authority in the form of a certified copy of a resolution naming the representative(s) authorized to sign the Agreement for and on behalf of the corporation or partnership; or*
 - (b) the affixing of a corporate seal, this Agreement should be properly sealed.*

DEFINITIONS

The following Definitions shall apply to all *Contract Documents*.

Change Directive

A *Change Directive* is a written instruction prepared by the *Consultant* and signed by the *Owner* directing the *Contractor* to proceed with a change in the *Work* within the general scope of the *Contract Documents* prior to the *Owner* and the *Contractor* agreeing upon adjustments in the *Contract Price* and the *Contract Time*.

Change Order

A *Change Order* is a written amendment to the *Contract* prepared by the *Consultant* and signed by the *Owner* and the *Contractor* stating their agreement upon:

- a change in the *Work*;
- the method of adjustment or the amount of the adjustment in the *Contract Price*, if any; and
- the extent of the adjustment in the *Contract Time*, if any.

Construction Equipment

Construction Equipment means all machinery and equipment, either operated or not operated, that is required for preparing, fabricating, conveying, erecting, or otherwise performing the *Work* but is not incorporated into the *Work*.

Consultant

The *Consultant* is the person or entity engaged by the *Owner* and identified as such in the Agreement. The *Consultant* is the Architect, the Engineer or entity licensed to practise in the province or territory of the *Place of the Work*.

Contract

The *Contract* is the undertaking by the parties to perform their respective duties, responsibilities and obligations as prescribed in the *Contract Documents* and represents the entire agreement between the parties.

Contract Documents

The *Contract Documents* consist of those documents listed in Article A-3 of the Agreement – CONTRACT DOCUMENTS and amendments agreed upon between the parties.

Contract Price

The *Contract Price* is the amount stipulated in Article A-4 of the Agreement – CONTRACT PRICE.

Contract Time

The *Contract Time* is the time from commencement of the *Work* to the date of *Ready-for-Takeover* as stipulated in paragraph 1.3 of Article A-1 of the Agreement – THE WORK.

Contractor

The *Contractor* is the person or entity identified as such in the Agreement.

Drawings

The *Drawings* are the graphic and pictorial portions of the *Contract Documents*, wherever located and whenever issued, showing the design, location and dimensions of the *Work*, generally including plans, elevations, sections, details, and diagrams.

Notice in Writing

A *Notice in Writing*, where identified in the *Contract Documents*, is a written communication between the parties or between them and the *Consultant* that is transmitted in accordance with the provisions of Article A-6 of the Agreement – RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING.

Owner

The *Owner* is the person or entity identified as such in the Agreement.

Other Contractor

Other Contractor means a contractor, other than the *Contractor* or a *Subcontractor*, engaged by the *Owner* for the *Project*.

Payment Legislation

Payment Legislation means such legislation in effect at the *Place of the Work* which governs payment under construction contracts.

Place of the Work

The *Place of the Work* is the designated site or location of the *Work* identified in the *Contract Documents*.

Product

Product or Products means material, machinery, equipment, and fixtures forming part of the *Work*, but does not include *Construction Equipment*.

Project

The *Project* means the total construction contemplated of which the *Work* may be the whole or a part.

Ready-for-Takeover

Ready-for-Takeover shall have been attained when the conditions set out in paragraph 12.1.1 of GC 12.1 – READY-FOR-TAKEOVER have been met, as verified by the *Consultant* pursuant to paragraph 12.1.4.2 of GC 12.1 – READY-FOR-TAKEOVER.

Shop Drawings

Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures, *Product* data, and other data which the *Contractor* provides to illustrate details of portions of the *Work*.

Specifications

The *Specifications* are that portion of the *Contract Documents*, wherever located and whenever issued, consisting of the written requirements and standards for *Products*, systems, workmanship, quality, and the services necessary for the performance of the *Work*.

Subcontractor

A *Subcontractor* is a person or entity having a direct contract with the *Contractor* to perform a part or parts of the *Work* at the *Place of the Work*.

Substantial Performance of the Work

Substantial Performance of the Work is as defined in the lien legislation applicable to the *Place of the Work*.

Supplemental Instruction

A *Supplemental Instruction* is an instruction, not involving adjustment in the *Contract Price* or *Contract Time*, in the form of *Specifications*, *Drawings*, schedules, samples, models, or written instructions, consistent with the intent of the *Contract Documents*. It is to be issued by the *Consultant* to supplement the *Contract Documents* as required for the performance of the *Work*.

Supplier

A *Supplier* is a person or entity having a direct contract with the *Contractor* to supply *Products*.

Temporary Work

Temporary Work means temporary supports, structures, facilities, services, and other temporary items, excluding *Construction Equipment*, required for the execution of the *Work* but not incorporated into the *Work*.

Value Added Taxes

Value Added Taxes means such sum as shall be levied upon the *Contract Price* by the Federal or any Provincial or Territorial Government and is computed as a percentage of the *Contract Price* and includes the Goods and Services Tax, the Quebec Sales Tax, the Harmonized Sales Tax, and any similar tax, the collection and payment of which have been imposed on the *Contractor* by tax legislation.

Work

The *Work* means the total construction and related services required by the *Contract Documents*.

Working Day

Working Day means a day other than a Saturday, Sunday, statutory holiday, or statutory vacation day that is observed by the construction industry in the area of the *Place of the Work*.

GENERAL CONDITIONS

PART 1 GENERAL PROVISIONS

GC 1.1 CONTRACT DOCUMENTS

- 1.1.1 The intent of the *Contract Documents* is to include the labour, *Products* and services necessary for the performance of the *Work* by the *Contractor* in accordance with these documents. It is not intended, however, that the *Contractor* shall supply products or perform work not consistent with, not covered by, or not properly inferable from the *Contract Documents*.
- 1.1.2 The *Contract Documents* are complementary, and what is required by one shall be as binding as if required by all. Performance by the *Contractor* shall be required only to the extent consistent with the *Contract Documents*.
- 1.1.3 The *Contractor* shall review the *Contract Documents* for the purpose of facilitating co-ordination and execution of the *Work* by the *Contractor*.
- 1.1.4 The *Contractor* is not responsible for errors, omissions or inconsistencies in the *Contract Documents*. If there are perceived errors, omissions or inconsistencies discovered by or made known to the *Contractor*, the *Contractor* shall promptly report to the *Consultant* and shall not proceed with the work affected until the *Contractor* has received corrected or additional information from the *Consultant*.
- 1.1.5 If there is a conflict within the *Contract Documents*:
 - .1 the order of priority of documents, from highest to lowest, shall be
 - the Agreement between *Owner* and *Contractor*,
 - the Definitions,
 - Supplementary Conditions,
 - the General Conditions,
 - Division 01 of the *Specifications*,
 - technical *Specifications*,
 - material and finishing schedules,
 - the *Drawings*.
 - .2 *Drawings* of larger scale shall govern over those of smaller scale of the same date.
 - .3 dimensions shown on *Drawings* shall govern over dimensions scaled from *Drawings*.
 - .4 amended or later dated documents shall govern over earlier documents of the same type.
 - .5 noted materials and annotations shall govern over graphic indications.
- 1.1.6 Nothing contained in the *Contract Documents* shall create any contractual relationship between:
 - .1 the *Owner* and a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any portion of the *Work*.
 - .2 the *Consultant* and the *Contractor*, a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any portion of the *Work*.
- 1.1.7 Words and abbreviations which have well known technical or trade meanings are used in the *Contract Documents* in accordance with such recognized meanings.
- 1.1.8 References in the *Contract Documents* to the singular shall be considered to include the plural as the context requires.
- 1.1.9 Neither the organization of the *Specifications* nor the arrangement of *Drawings* shall control the *Contractor* in dividing the work among *Subcontractors* and *Suppliers*.
- 1.1.10 *Specifications*, *Drawings*, models, and copies thereof furnished by the *Consultant* are and shall remain the *Consultant's* property, with the exception of the signed *Contract* sets, which shall belong to each party to the *Contract*. All *Specifications*, *Drawings* and models furnished by the *Consultant* are to be used only with respect to the *Work* and are not to be used on other work. These *Specifications*, *Drawings* and models are not to be copied or altered in any manner without the written authorization of the *Consultant*.
- 1.1.11 Physical models furnished by the *Contractor* at the *Owner's* expense are the property of the *Owner*.

GC 1.2 LAW OF THE CONTRACT

- 1.2.1 The law of the *Place of the Work* shall govern the interpretation of the *Contract*.

GC 1.3 RIGHTS AND REMEDIES

- 1.3.1 Except as expressly provided in the *Contract Documents*, the duties and obligations imposed by the *Contract Documents* and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights, and remedies otherwise imposed or available by law.

- 1.3.2 No action or failure to act by the *Owner*, the *Consultant* or the *Contractor* shall constitute a waiver of any right or duty afforded any of them under the *Contract*, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

GC 1.4 ASSIGNMENT

- 1.4.1 Neither party to the *Contract* shall assign the *Contract* or a portion thereof without the written consent of the other, which consent shall not be unreasonably withheld.

PART 2 ADMINISTRATION OF THE CONTRACT

GC 2.1 AUTHORITY OF THE CONSULTANT

- 2.1.1 The *Consultant* will have authority to act on behalf of the *Owner* only to the extent provided in the *Contract Documents*, unless otherwise modified by written agreement as provided in paragraph 2.1.2.
- 2.1.2 The duties, responsibilities and limitations of authority of the *Consultant* as set forth in the *Contract Documents* shall be modified or extended only with the written consent of the *Owner*, the *Consultant* and the *Contractor*.

GC 2.2 ROLE OF THE CONSULTANT

- 2.2.1 The *Consultant* will provide administration of the *Contract* as described in the *Contract Documents*.
- 2.2.2 The *Consultant* will visit the *Place of the Work* at intervals appropriate to the progress of construction to become familiar with the progress and quality of the work and to determine if the *Work* is proceeding in general conformity with the *Contract Documents*.
- 2.2.3 If the *Owner* and the *Consultant* agree, the *Consultant* will provide at the *Place of the Work*, one or more project representatives to assist in carrying out the *Consultant's* responsibilities. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in writing to the *Contractor*.
- 2.2.4 Based on the *Consultant's* observations and evaluation of the *Contractor's* applications for payment, the *Consultant* will determine the amounts owing to the *Contractor* under the *Contract* and will issue certificates for payment as provided in Article A-5 of the Agreement – PAYMENT, GC 5.3 – PAYMENT and GC 5.5 – FINAL PAYMENT.
- 2.2.5 The *Consultant* will not be responsible for and will not have control, charge or supervision of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs required in connection with the *Work* in accordance with the applicable construction safety legislation, other regulations or general construction practice. The *Consultant* will not be responsible for the *Contractor's* failure to perform the *Work* in accordance with the *Contract Documents*.
- 2.2.6 Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER, the *Consultant* will be, in the first instance, the interpreter of the requirements of the *Contract Documents*.
- 2.2.7 Matters in question relating to the performance of the *Work* or the interpretation of the *Contract Documents* shall be initially referred in writing to the *Consultant* by the party raising the question for interpretations and findings and copied to the other party.
- 2.2.8 Interpretations and findings of the *Consultant* shall be consistent with the intent of the *Contract Documents*. In making such interpretations and findings the *Consultant* will not show partiality to either the *Owner* or the *Contractor*.
- 2.2.9 The *Consultant's* interpretations and findings will be given in writing to the parties within a reasonable time.
- 2.2.10 With respect to claims for a change in *Contract Price*, the *Consultant* will make findings as set out in GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE.
- 2.2.11 The *Consultant* will have authority to reject work which in the *Consultant's* opinion does not conform to the requirements of the *Contract Documents*. Whenever the *Consultant* considers it necessary or advisable, the *Consultant* will have authority to require inspection or testing of work, whether or not such work is fabricated, installed or completed. However, neither the authority of the *Consultant* to act nor any decision either to exercise or not to exercise such authority shall give rise to any duty or responsibility of the *Consultant* to the *Contractor*, *Subcontractors*, *Suppliers*, or their agents, employees, or other persons performing any of the *Work*.
- 2.2.12 During the progress of the *Work* the *Consultant* will furnish *Supplemental Instructions* to the *Contractor* with reasonable promptness or in accordance with a schedule for such instructions agreed to by the *Consultant* and the *Contractor*.
- 2.2.13 The *Consultant* will review and take appropriate action upon *Shop Drawings*, samples and other submittals by the *Contractor*, in accordance with the *Contract Documents*.

- 2.2.14 The *Consultant* will prepare *Change Orders* and *Change Directives* as provided in GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.
- 2.2.15 The *Consultant* will conduct reviews of the *Work* to determine the date of *Substantial Performance of the Work* and verify that *Ready-for-Takeover* has been attained.
- 2.2.16 All certificates issued by the *Consultant* will be to the best of the *Consultant's* knowledge, information and belief. By issuing any certificate, the *Consultant* does not guarantee the *Work* is correct or complete.
- 2.2.17 The *Consultant* will receive and review written warranties and related documents required by the *Contract* and provided by the *Contractor* and will forward such warranties and documents to the *Owner* for the *Owner's* acceptance.
- 2.2.18 If the *Consultant's* engagement is terminated, the *Owner* shall immediately engage a *Consultant* against whom the *Contractor* makes no reasonable objection and whose duties and responsibilities under the *Contract Documents* will be that of the former *Consultant*.

GC 2.3 REVIEW AND INSPECTION OF THE WORK

- 2.3.1 The *Owner* and the *Consultant* shall have access to the *Work* at all times. The *Contractor* shall provide sufficient, safe and proper facilities at all times for the review of the *Work* by the *Consultant* and the inspection of the *Work* by authorized agencies. If parts of the *Work* are in preparation at locations other than the *Place of the Work*, the *Owner* and the *Consultant* shall be given access to such work whenever it is in progress.
- 2.3.2 If work is designated for tests, inspections or approvals in the *Contract Documents*, by the *Consultant's* instructions, or by the laws or ordinances of the *Place of the Work*, the *Contractor* shall give the *Consultant* reasonable notification of when the work will be ready for review and inspection. The *Contractor* shall arrange for and shall give the *Consultant* reasonable notification of the date and time of inspections by other authorities.
- 2.3.3 The *Contractor* shall furnish promptly to the *Consultant* two copies of certificates and inspection reports relating to the *Work*.
- 2.3.4 If the *Contractor* covers, or permits to be covered, work that has been designated for special tests, inspections or approvals before such special tests, inspections or approvals are made, given or completed, the *Contractor* shall, if so directed, uncover such work, have the inspections or tests satisfactorily completed, and make good covering work at the *Contractor's* expense.
- 2.3.5 The *Consultant* may order any portion or portions of the *Work* to be examined to confirm that such work is in accordance with the requirements of the *Contract Documents*. If the work is not in accordance with the requirements of the *Contract Documents*, the *Contractor* shall correct the work and pay the cost of examination and correction. If the work is in accordance with the requirements of the *Contract Documents*, the *Owner* shall pay the cost of examination and restoration.
- 2.3.6 The *Contractor* shall pay the cost of making any test or inspection, including the cost of samples required for such test or inspection, if such test or inspection is designated in the *Contract Documents* to be performed by the *Contractor* or is required by the laws or ordinances applicable to the *Place of the Work*.
- 2.3.7 The *Contractor* shall pay the cost of samples required for any test or inspection to be performed by others if such test or inspection is designated in the *Contract Documents*.

GC 2.4 DEFECTIVE WORK

- 2.4.1 The *Contractor* shall promptly correct defective work that has been rejected by the *Consultant* as failing to conform to the *Contract Documents* whether or not the defective work was incorporated in the *Work* or the defect is the result of poor workmanship, use of defective products or damage through carelessness or other act or omission of the *Contractor*.
- 2.4.2 The *Contractor* shall make good promptly *Other Contractors' work* destroyed or damaged by such corrections at the *Contractor's* expense.
- 2.4.3 If in the opinion of the *Consultant* it is not expedient to correct defective work or work not performed as provided in the *Contract Documents*, the *Owner* may deduct from the amount otherwise due to the *Contractor* the difference in value between the work as performed and that called for by the *Contract Documents*. If the *Owner* and the *Contractor* do not agree on the difference in value, they shall refer the matter to the *Consultant* for a finding.

PART 3 EXECUTION OF THE WORK

GC 3.1 CONTROL OF THE WORK

- 3.1.1 The *Contractor* shall have total control of the *Work* and shall effectively direct and supervise the *Work* so as to ensure conformity with the *Contract Documents*.

- 3.1.2 The *Contractor* shall be solely responsible for construction means, methods, techniques, sequences, and procedures and for co-ordinating the various parts of the *Work* under the *Contract*.

GC 3.2 CONSTRUCTION BY THE OWNER OR OTHER CONTRACTORS

- 3.2.1 The *Owner* reserves the right to award separate contracts in connection with other parts of the *Project* to *Other Contractors* and to perform work with own forces.
- 3.2.2 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner's* own forces, the *Owner* shall:
- .1 provide for the co-ordination of the activities and work of *Other Contractors* and the *Owner's* own forces with the *Work* of the *Contract*;
 - .2 enter into separate contracts with *Other Contractors* under conditions of contract which are compatible with the conditions of the *Contract*;
 - .3 ensure that insurance coverage is provided to the same requirements as are called for in GC 11.1 – INSURANCE and co-ordinate such insurance with the insurance coverage of the *Contractor* as it affects the *Work*; and
 - .4 take all reasonable precautions to avoid labour disputes or other disputes on the *Project* arising from the work of *Other Contractors* or the *Owner's* own forces.
- 3.2.3 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner's* own forces, the *Contractor* shall:
- .1 afford the *Owner* and *Other Contractors* reasonable opportunity to store their products and execute their work;
 - .2 co-ordinate and schedule the *Work* with the work of *Other Contractors* or the *Owner's* own forces that are identified in the *Contract Documents*;
 - .3 participate with *Other Contractors* and the *Owner* in reviewing their construction schedules when directed to do so; and
 - .4 report promptly to the *Consultant* in writing any apparent deficiencies in the work of *Other Contractors* or of the *Owner's* own forces, where such work affects the proper execution of any portion of the *Work*, prior to proceeding with that portion of the *Work*.
- 3.2.4 Where a change in the *Work* is required as a result of the co-ordination and integration of the work of *Other Contractors* or *Owner's* own forces with the *Work*, the changes shall be authorized and valued as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.
- 3.2.5 Disputes and other matters in question between the *Contractor* and *Other Contractors* shall be dealt with as provided in Part 8 of the General Conditions – DISPUTE RESOLUTION provided the *Other Contractors* have reciprocal obligations. The *Contractor* shall be deemed to have consented to arbitration of any dispute with any *Other Contractor* whose contract with the *Owner* contains a similar agreement to arbitrate. In the absence of *Other Contractors* having reciprocal obligations, disputes and other matters in question initiated by the *Contractor* against *Other Contractors* will be considered disputes and other matters in question between the *Contractor* and the *Owner*.
- 3.2.6 Should the *Owner*, the *Consultant*, *Other Contractors*, or anyone employed by them directly or indirectly be responsible for ill-timed work necessitating cutting or remedial work to be performed, the cost of such cutting or remedial work shall be valued as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

GC 3.3 TEMPORARY WORK

- 3.3.1 The *Contractor* shall have the sole responsibility for the design, erection, operation, maintenance, and removal of *Temporary Work* unless otherwise specified in the *Contract Documents*.
- 3.3.2 The *Contractor* shall engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform those functions referred to in paragraph 3.3.1 where required by law or by the *Contract Documents* and in all cases where such *Temporary Work* is of such a nature that professional engineering skill is required to produce safe and satisfactory results.
- 3.3.3 Notwithstanding the provisions of GC 3.1 – CONTROL OF THE WORK, paragraphs 3.3.1 and 3.3.2 or provisions to the contrary elsewhere in the *Contract Documents* where such *Contract Documents* include designs for *Temporary Work* or specify a method of construction in whole or in part, such designs or methods of construction shall be considered to be part of the design of the *Work* and the *Contractor* shall not be held responsible for that part of the design or the specified method of construction. The *Contractor* shall, however, be responsible for the execution of such design or specified method of construction in the same manner as for the execution of the *Work*.

GC 3.4 CONSTRUCTION SCHEDULE**3.4.1** The *Contractor* shall:

- .1 prepare and submit to the *Owner* and the *Consultant* prior to the first application for payment, a construction schedule that indicates the timing of the major activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time*;
- .2 monitor the progress of the *Work* relative to the construction schedule and update the schedule on a monthly basis or as stipulated by the *Contract Documents*; and
- .3 advise the *Consultant* of any revisions required to the schedule as the result of extensions of the *Contract Time* as provided in Part 6 of the General Conditions – CHANGES IN THE WORK.

GC 3.5 SUPERVISION

3.5.1 The *Contractor* shall provide all necessary supervision and appoint a competent representative who shall be in attendance at the *Place of the Work* while the *Work* is being performed. The appointed representative shall not be changed except for valid reason.

3.5.2 The appointed representative shall represent the *Contractor* at the *Place of the Work*. Information and instructions provided by the *Consultant* to the *Contractor's* appointed representative shall be deemed to have been received by the *Contractor*, except with respect to Article A-6 of the Agreement – RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING.

GC 3.6 SUBCONTRACTORS AND SUPPLIERS

3.6.1 The *Contractor* shall preserve and protect the rights of the parties under the *Contract* with respect to work to be performed under subcontract, and shall:

- .1 enter into contracts or written agreements with *Subcontractors* and *Suppliers* to require them to perform their work as provided in the *Contract Documents*;
- .2 incorporate the applicable terms and conditions of the *Contract Documents* into all contracts or written agreements with *Subcontractors* and *Suppliers*; and
- .3 be as fully responsible to the *Owner* for acts and omissions of *Subcontractors*, *Suppliers* and any persons directly or indirectly employed by them as for acts and omissions of persons directly employed by the *Contractor*.

3.6.2 The *Contractor* shall indicate in writing, if requested by the *Owner*, those *Subcontractors* or *Suppliers* whose bids have been received by the *Contractor* which the *Contractor* would be prepared to accept for the performance of a portion of the *Work*. Should the *Owner* not object before signing the *Contract*, the *Contractor* shall employ those *Subcontractors* or *Suppliers* so identified by the *Contractor* in writing for the performance of that portion of the *Work* to which their bid applies.

3.6.3 The *Owner* may, for reasonable cause, at any time before the *Owner* has signed the *Contract*, object to the use of a proposed *Subcontractor* or *Supplier* and require the *Contractor* to employ one of the other subcontract bidders.

3.6.4 If the *Owner* requires the *Contractor* to change a proposed *Subcontractor* or *Supplier*, the *Contract Price* and *Contract Time* shall be adjusted by the difference occasioned by such required change.

3.6.5 The *Contractor* shall not be required to employ as a *Subcontractor* or *Supplier*, a person or firm to which the *Contractor* may reasonably object.

3.6.6 The *Owner*, through the *Consultant*, may provide to a *Subcontractor* or *Supplier* information as to the percentage of the *Subcontractor's* or *Supplier's* work which has been certified for payment.

GC 3.7 LABOUR AND PRODUCTS

3.7.1 The *Contractor* shall maintain good order and discipline among the *Contractor's* employees engaged on the *Work* and employ only workers that are skilled in the tasks assigned.

3.7.2 The *Contractor* shall provide and pay for labour, *Products*, tools, *Construction Equipment*, water, heat, light, power, transportation, and other facilities and services necessary for the performance of the *Work* in accordance with the *Contract*.

3.7.3 Unless otherwise specified in the *Contract Documents*, *Products* provided shall be new. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*.

GC 3.8 SHOP DRAWINGS

3.8.1 The *Contractor* shall provide *Shop Drawings* as required in the *Contract Documents*.

3.8.2 The *Contractor* shall provide *Shop Drawings* to the *Consultant* to review in accordance with an agreed schedule, or in the absence of an agreed schedule, in orderly sequence and sufficiently in advance so as to cause no delay in the *Work* or in the work of *Other Contractors* or the *Owner's* own forces.

- 3.8.3 The *Contractor* shall review all *Shop Drawings* before providing them to the *Consultant*. The *Contractor* represents by this review that:
- .1 the *Contractor* has determined and verified all applicable field measurements, field construction conditions, *Product* requirements, catalogue numbers and similar data, or will do so, and
 - .2 the *Contractor* has checked and co-ordinated each *Shop Drawing* with the requirements of the *Work* and of the *Contract Documents*.
- 3.8.4 The *Consultant's* review is for conformity to the design concept and for general arrangement only.
- 3.8.5 At the time of providing *Shop Drawings*, the *Contractor* shall expressly advise the *Consultant* in writing of any deviations in a *Shop Drawing* from the requirements of the *Contract Documents*. The *Consultant* shall indicate the acceptance or rejection of such deviation expressly in writing.
- 3.8.6 The *Consultant's* review shall not relieve the *Contractor* of responsibility for errors or omissions in the *Shop Drawings* or for meeting all requirements of the *Contract Documents*.
- 3.8.7 The *Consultant* will review and return *Shop Drawings* in accordance with the schedule agreed upon, or, in the absence of such schedule, with reasonable promptness so as to cause no delay in the performance of the *Work*.

PART 4 ALLOWANCES

GC 4.1 CASH ALLOWANCES

- 4.1.1 The *Contract Price* includes the cash allowances, if any, stated in the *Contract Documents*. The scope of the *Work* or costs included in such cash allowances shall be as described in the *Contract Documents*.
- 4.1.2 The *Contract Price*, and not the cash allowances, includes the *Contractor's* overhead and profit in connection with such cash allowances.
- 4.1.3 Expenditures under cash allowances shall be authorized by the *Owner* through the *Consultant*.
- 4.1.4 Where the actual cost of the *Work* under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, at the *Consultant's* direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the *Contract Price* for overhead and profit. Only where the actual cost of the *Work* under all cash allowances exceeds the total amount of all cash allowances shall the *Contractor* be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the *Contract Documents*.
- 4.1.5 The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the *Contract Price* by *Change Order* without any adjustment for the *Contractor's* overhead and profit on such amount.
- 4.1.6 The value of the *Work* performed under a cash allowance is eligible to be included in progress payments.
- 4.1.7 The *Contractor* and the *Consultant* shall jointly prepare a schedule that shows when the items called for under cash allowances must be ordered to avoid delaying the progress of the *Work*.

GC 4.2 CONTINGENCY ALLOWANCE

- 4.2.1 The *Contract Price* includes the contingency allowance, if any, stated in the *Contract Documents*.
- 4.2.2 The contingency allowance includes the *Contractor's* overhead and profit in connection with such contingency allowance.
- 4.2.3 Expenditures under the contingency allowance shall be authorized and valued as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.
- 4.2.4 The *Contract Price* shall be adjusted by *Change Order* to provide for any difference between the expenditures authorized under paragraph 4.2.3 and the contingency allowance.

PART 5 PAYMENT

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

- 5.1.1 The *Owner* shall, at the request of the *Contractor*, before signing the *Contract*, and promptly from time to time thereafter, furnish to the *Contractor* reasonable evidence that financial arrangements have been made to fulfill the *Owner's* obligations under the *Contract*.
- 5.1.2 The *Owner* shall give the *Contractor Notice in Writing* of any material change in the *Owner's* financial arrangements to fulfil the *Owner's* obligations under the *Contract* during the performance of the *Contract*.

GC 5.2 APPLICATIONS FOR PAYMENT

- 5.2.1 Applications for payment on account as provided in Article A-5 of the Agreement – PAYMENT shall be submitted monthly to the *Owner* and the *Consultant* simultaneously as the *Work* progresses.
- 5.2.2 Applications for payment shall be dated the last day of each payment period, which is the last day of the month or an alternative day of the month agreed in writing by the parties.
- 5.2.3 The amount claimed shall be for the value, proportionate to the amount of the *Contract*, of *Work* performed and *Products* delivered to the *Place of the Work* as of the last day of the payment period.
- 5.2.4 The *Contractor* shall submit to the *Consultant*, at least 15 calendar days before the first application for payment, a schedule of values for the parts of the *Work*, aggregating the total amount of the *Contract Price*, so as to facilitate evaluation of applications for payment.
- 5.2.5 The schedule of values shall be made out in such form as specified in the *Contract* and supported by such evidence as the *Consultant* may reasonably require.
- 5.2.6 Applications for payment shall be based on the schedule of values accepted by the *Consultant* and shall comply with the provisions of *Payment Legislation*.
- 5.2.7 Each application for payment shall include evidence of compliance with workers' compensation legislation at the *Place of the Work* and after the first payment, a declaration by the *Contractor* as to the distribution made of the amounts previously received using document CCDC 9A 'Statutory Declaration'.
- 5.2.8 Applications for payment for *Products* delivered to the *Place of the Work* but not yet incorporated into the *Work* shall be supported by such evidence as the *Consultant* may reasonably require to establish the value and delivery of the *Products*.

GC 5.3 PAYMENT

- 5.3.1 After receipt by the *Consultant* and the *Owner* of an application for payment submitted by the *Contractor* in accordance with GC 5.2 – APPLICATIONS FOR PAYMENT:
 - .1 The *Consultant* will issue to the *Owner* and copy to the *Contractor*, no later than 10 calendar days after the receipt of the application for payment, a certificate for payment in the amount applied for, or in such other amount as the *Consultant* determines to be properly due. If the *Consultant* certifies a different amount, or rejects the application or part thereof, the *Owner* shall promptly issue a written notice to the *Contractor* giving reasons for the revision or rejection, such written notice to be in compliance with *Payment Legislation*.
 - .2 The *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement – PAYMENT on or before 28 calendar days after the receipt by the *Owner* and the *Consultant* of the application for payment, and in any event, in compliance with *Payment Legislation*.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

- 5.4.1 The *Consultant* will review the *Work* to certify or verify the validity of the application for *Substantial Performance of the Work* and will promptly, and in any event, no later than 20 calendar days after receipt of the *Contractors* application:
 - .1 advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or
 - .2 state the date of *Substantial Performance of the Work* or a designated portion of the *Work* in a certificate and issue a copy of that certificate to each of the *Owner* and the *Contractor*.
- 5.4.2 Where the holdback amount required by the applicable lien legislation has not been placed in a separate lien holdback account, the *Owner* shall, no later than 10 calendar days prior to the expiry of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*, place the holdback amount in a bank account in the joint names of the *Owner* and the *Contractor*.
- 5.4.3 Subject to the requirements of any *Payment Legislation*, all holdback amount prescribed by the applicable lien legislation for the *Work* shall become due and payable to the *Contractor* no later than 10 *Working Days* following the expiration of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*.
- 5.4.4 The *Contractor* shall submit an application for payment of the lien holdback amount in accordance with GC 5.3 – PAYMENT.
- 5.4.5 Where legislation permits progressive release of the holdback for a portion of the *Work* and the *Consultant* has certified or verified that the part of the *Work* has been performed prior to *Substantial Performance of the Work*, the *Owner* hereby agrees to release, and shall release, such portion to the *Contractor* in accordance with such legislation.

- 5.4.6 Notwithstanding any progressive release of the holdback, the *Contractor* shall ensure that such parts of the *Work* are protected pending the issuance of a final certificate for payment and be responsible for the correction of defects or work not performed regardless of whether or not such was apparent when the holdback was released.

GC 5.5 FINAL PAYMENT

- 5.5.1 When the *Contractor* considers that the *Work* is completed, the *Contractor* shall submit an application for final payment.
- 5.5.2 The *Consultant* will, no later than 10 calendar days after the receipt of an application from the *Contractor* for final payment, review the *Work* to verify the validity of the application and when the *Consultant* finds the *Contractor's* application for final payment valid, the *Consultant* will promptly issue a final certificate for payment to the *Owner*, with a copy to the *Contractor*.
- 5.5.3 If the *Consultant* rejects the application or part thereof, the *Owner* will promptly issue a written notice to the *Contractor* giving reasons for the revision or rejection, such written notice to be in compliance with *Payment Legislation*.
- 5.5.4 Subject to the provision of paragraph 10.4.1 of GC 10.4 – WORKERS' COMPENSATION, and any legislation applicable to the *Place of the Work*, the *Owner* shall, no later than 5 calendar days after the issuance of a final certificate for payment, pay the *Contractor* as provided in Article A-5 of the Agreement – PAYMENT and in any event, in compliance with *Payment Legislation*.

GC 5.6 DEFERRED WORK

- 5.6.1 If because of climatic or other conditions reasonably beyond the control of the *Contractor*, or if the *Owner* and the *Contractor* agree that, there are items of work that must be deferred, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such deferred *Work*.

GC 5.7 NON-CONFORMING WORK

- 5.7.1 No payment by the *Owner* under the *Contract* nor partial or entire use or occupancy of the *Work* by the *Owner* shall constitute an acceptance of any portion of the *Work* or *Products* which are not in accordance with the requirements of the *Contract Documents*.

PART 6 CHANGES IN THE WORK

GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

- 6.1.1 The *Owner*, through the *Consultant*, without invalidating the *Contract*, may make:
- .1 changes in the *Work* consisting of additions, deletions or other revisions to the *Work* by *Change Order* or *Change Directive*, and
 - .2 changes to the *Contract Time* for the *Work*, or any part thereof, by *Change Order*.
- 6.1.2 The *Contractor* shall not perform a change in the *Work* without a *Change Order* or a *Change Directive*.

GC 6.2 CHANGE ORDER

- 6.2.1 When a change in the *Work* is proposed or required, the *Consultant* will provide the *Contractor* with a written description of the proposed change in the *Work*. The *Contractor* shall promptly present to the *Consultant*, in a form that can be reasonably evaluated, a method of adjustment or an amount of adjustment for the *Contract Price*, if any, and the adjustment in the *Contract Time*, if any, for the proposed change in the *Work*.
- 6.2.2 When the *Owner* and the *Contractor* agree to the adjustments in the *Contract Price* and *Contract Time* or to the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a *Change Order*. The value of the work performed as the result of a *Change Order* shall be included in the applications for progress payment.

GC 6.3 CHANGE DIRECTIVE

- 6.3.1 If the *Owner* requires the *Contractor* to proceed with a change in the *Work* prior to the *Owner* and the *Contractor* agreeing upon the corresponding adjustment in *Contract Price* and *Contract Time*, the *Owner*, through the *Consultant*, shall issue a *Change Directive*.
- 6.3.2 A *Change Directive* shall only be used to direct a change in the *Work* which is within the general scope of the *Contract Documents*.
- 6.3.3 A *Change Directive* shall not be used to direct a change in the *Contract Time* only.

- 6.3.4 Upon receipt of a *Change Directive*, the *Contractor* shall proceed promptly with the change in the *Work*.
- 6.3.5 For the purpose of valuing *Change Directives*, changes in the *Work* that are not substitutions or otherwise related to each other shall not be grouped together in the same *Change Directive*.
- 6.3.6 The adjustment in the *Contract Price* for a change carried out by way of a *Change Directive* shall be determined on the basis of the cost of the *Contractor's* actual expenditures and savings attributable to the *Change Directive*, valued in accordance with paragraph 6.3.7 and as follows:
- 1 If the change results in a net increase in the *Contractor's* cost, the *Contract Price* shall be increased by the amount of the net increase in the *Contractor's* cost, plus the *Contractor's* percentage fee on such net increase.
 - 2 If the change results in a net decrease in the *Contractor's* cost, the *Contract Price* shall be decreased by the amount of the net decrease in the *Contractor's* cost, without adjustment for the *Contractor's* percentage fee.
 - 3 The *Contractor's* fee shall be as specified in the *Contract Documents* or as otherwise agreed by the parties.
- 6.3.7 The cost of performing the work attributable to the *Change Directive* shall be limited to the actual cost of the following in as much as it contributes directly to the implementation of the *Change Directive*:

Labour

- 1 rates that are listed in the schedule or as agreed by the *Owner* and the *Contractor* including wages, benefits, compensation, contributions, assessments, or taxes incurred for such items as employment insurance, provincial or territorial health insurance, workers' compensation, and Canada or Quebec Pension Plan for:
 - (1) trade labour in the direct employ of the *Contractor*;
 - (2) the *Contractor's* personnel when stationed at the field office;
 - (3) the *Contractor's* personnel engaged at shops or on the road, in expediting the production or transportation of materials or equipment; and
 - (4) the *Contractor's* office personnel engaged in a technical capacity, or other personnel identified in Article A-3 of the Agreement – CONTRACT DOCUMENTS for the time spent in the performance of the *Work*;

Products, Construction Equipment and Temporary Work

- 2 cost of all *Products* including cost of transportation thereof;
- 3 in the absence of agreed rates, cost less salvage value of *Construction Equipment*, *Temporary Work* and tools, exclusive of hand tools under \$1,000 owned by the *Contractor*;
- 4 rental cost of *Construction Equipment*, *Temporary Work* and tools, exclusive of hand tools under \$1,000;
- 5 cost of all equipment and services required for the *Contractor's* field office;

Subcontract

- 6 subcontract amounts of Subcontractor with pricing mechanism approved by the *Owner*;

Others

- 7 travel and subsistence expenses of the *Contractor's* personnel described in paragraph 6.3.7.1;
- 8 deposits lost provided that they are not caused by negligent acts or omissions of the *Contractor*;
- 9 cost of quality assurance such as independent inspection and testing services;
- 10 charges levied by authorities having jurisdiction at the *Place of the Work*;
- 11 royalties, patent license fees, and damages for infringement of patents and cost of defending suits therefor subject always to the *Contractor's* obligations to indemnify the *Owner* as provided in paragraph 10.3.1 of GC 10.3 – PATENT FEES;
- 12 premium for all contract securities and insurance for which the *Contractor* is required, by the *Contract Documents*, to provide, maintain and pay in relation to the performance of the *Work*;
- 13 losses and expenses sustained by the *Contractor* for matters which are the subject of insurance under the policies prescribed in GC 11.1 – INSURANCE when such losses and expenses are not recoverable because the amounts are in excess of collectible amounts or within the deductible amounts;
- 14 taxes and duties, other than *Value Added Taxes*, income, capital, or property taxes, relating to the *Work* for which the *Contractor* is liable;
- 15 charges for voice and data communications, courier services, expressage, transmittal and reproduction of documents, and petty cash items;
- 16 cost for removal and disposal of waste products and debris;
- 17 legal costs, incurred by the *Contractor*, in relation to the performance of the *Work* provided that they are not:
 - (1) relating to a dispute between the *Owner* and the *Contractor* unless such costs are part of a settlement or awarded by arbitration or court,
 - (2) the result of the negligent acts or omissions of the *Contractor*, or
 - (3) the result of a breach of this *Contract* by the *Contractor*;
- 18 cost of auditing when requested by the *Owner*; and
- 19 cost of *Project* specific information technology in accordance with the method determined by the parties.

- 6.3.8 Notwithstanding any other provisions contained in the General Conditions of the *Contract*, it is the intention of the parties that the cost of any item under any cost element referred to in paragraph 6.3.7 shall cover and include any and all costs or liabilities attributable to the *Change Directive* other than those which are the result of or occasioned by any failure on the part of the *Contractor* to exercise reasonable care and diligence in the *Contractor's* attention to the *Work*. Any cost due to failure on the part of the *Contractor* to exercise reasonable care and diligence in the *Contractor's* performance of the *Work* attributable to the *Change Directive* shall be borne by the *Contractor*.
- 6.3.9 The *Contractor* shall keep full and detailed accounts and records necessary for the documentation of the cost of performing the *Work* attributable to the *Change Directive* and shall provide the *Consultant* with copies thereof.
- 6.3.10 For the purpose of valuing *Change Directives*, the *Owner* shall be afforded reasonable access to all of the *Contractor's* pertinent documents related to the cost of performing the *Work* attributable to the *Change Directive*.
- 6.3.11 Pending determination of the final amount of a *Change Directive*, the undisputed value of the *Work* performed as the result of a *Change Directive* is eligible to be included in progress payments.
- 6.3.12 If the *Owner* and the *Contractor* do not agree on the proposed adjustment in the *Contract Time* attributable to the change in the *Work*, or the method of determining it, the adjustment shall be referred to the *Consultant* for a finding.
- 6.3.13 When the *Owner* and the *Contractor* reach agreement on the adjustment to the *Contract Price* and to the *Contract Time*, this agreement shall be recorded in a *Change Order*.

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

- 6.4.1 If the *Owner* or the *Contractor* discover conditions at the *Place of the Work* which are:
- .1 subsurface or otherwise concealed physical conditions which existed before the commencement of the *Work* and differ materially from those indicated in the *Contract Documents*; or
 - .2 physical conditions, other than conditions due to weather, that are of a nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the *Contract Documents*,
- then the observing party shall give *Notice in Writing* to the other party of such conditions before they are disturbed and in no event later than 5 *Working Days* after first observance of the conditions.
- 6.4.2 The *Consultant* will promptly investigate such conditions and make a finding. If the finding is that the conditions differ materially and this would cause an increase or decrease in the *Contractor's* cost or time to perform the *Work*, the *Owner*, through the *Consultant*, shall issue appropriate instructions for a change in the *Work* as provided in GC 6.2 – CHANGE ORDER or GC 6.3 – CHANGE DIRECTIVE.
- 6.4.3 If the *Consultant* finds that the conditions at the *Place of the Work* are not materially different or that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* will promptly inform the *Owner* and the *Contractor* in writing.
- 6.4.4 If such concealed or unknown conditions relate to toxic and hazardous substances and materials, artifacts and fossils, or mould, the parties will be governed by the provisions of GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES, GC 9.3 – ARTIFACTS AND FOSSILS and GC 9.5 – MOULD.

GC 6.5 DELAYS

- 6.5.1 If the *Contractor* is delayed in the performance of the *Work* by the *Owner*, the *Consultant*, or anyone employed or engaged by them directly or indirectly, contrary to the provisions of the *Contract Documents*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The *Contractor* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Contractor* as the result of such delay.
- 6.5.2 If the *Contractor* is delayed in the performance of the *Work* by a stop work order issued by a court or other public authority and providing that such order was not issued as the result of an act or fault of the *Contractor* or any person employed or engaged by the *Contractor* directly or indirectly, resulting in the failure of the *Contractor* to attain *Ready-for-Takeover* by the date stipulated in Article A-1 of the Agreement – THE WORK, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The *Contractor* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Contractor* as the result of such delay.
- 6.5.3 If the *Contractor* is delayed in the performance of the *Work* by:
- .1 labour disputes, strikes, lock-outs (including lock-outs decreed or recommended for its members by a recognized contractors' association, of which the *Contractor* is a member or to which the *Contractor* is otherwise bound),
 - .2 fire, unusual delay by common carriers or unavoidable casualties,
 - .3 abnormally adverse weather conditions, or

- .4 any cause beyond the *Contractor's* control other than one resulting from a default or breach of *Contract* by the *Contractor*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays unless such delays result from actions by the *Owner*, the *Consultant* or anyone employed or engaged by them directly or indirectly.
- 6.5.4 No extension shall be made for delay unless *Notice in Writing* of the cause of delay is given to the *Consultant* not later than 10 *Working Days* after the commencement of the delay. In the case of a continuing cause of delay only one *Notice in Writing* shall be necessary.
- 6.5.5 If no schedule is made under paragraph 2.2.12 of GC 2.2 – ROLE OF THE CONSULTANT, then no request for extension shall be made because of failure of the *Consultant* to furnish instructions until 10 *Working Days* after demand for such instructions has been made.

GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

- 6.6.1 If the *Contractor* intends to make a claim for an increase to the *Contract Price*, or if the *Owner* intends to make a claim against the *Contractor* for a credit to the *Contract Price*, the party that intends to make the claim shall give timely *Notice in Writing* of intent to claim to the other party and to the *Consultant*.
- 6.6.2 Upon commencement of the event or series of events giving rise to a claim, the party intending to make the claim shall:
- .1 take all reasonable measures to mitigate any loss or expense which may be incurred as a result of such event or series of events, and
 - .2 keep such records as may be necessary to support the claim.
- 6.6.3 The party making the claim shall submit within a reasonable time to the *Consultant* a detailed account of the amount claimed and the grounds upon which the claim is based and the *Consultant* will make a finding upon such claim.
- 6.6.4 Where the event or series of events giving rise to the claim has a continuing effect, the detailed account submitted under paragraph 6.6.3 shall be considered to be an interim account and the party making the claim shall, at such intervals as the *Consultant* may reasonably require, submit further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. The party making the claim shall submit a final account after the end of the effects resulting from the event or series of events.
- 6.6.5 The *Consultant's* findings, with respect to a claim made by either party, will be given by *Notice in Writing* to both parties within 30 *Working Days* after receipt of the claim by the *Consultant*, or within such other time period as may be agreed by the parties.
- 6.6.6 If such finding is not acceptable to either party, the claim shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION.

PART 7 DEFAULT NOTICE

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

- 7.1.1 If the *Contractor* is adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Contractor's* insolvency, or if a receiver is appointed because of the *Contractor's* insolvency, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, terminate the *Contractor's* right to continue with the *Work*, by giving the *Contractor* or receiver or trustee in bankruptcy *Notice in Writing* to that effect.
- 7.1.2 If the *Contractor* neglects to perform the *Work* properly or otherwise fails to comply with the requirements of the *Contract* to a substantial degree and if the *Consultant* has given a written statement to the *Owner* and *Contractor* which provides the detail of such neglect to perform the *Work* properly or such failure to comply with the requirements of the *Contract* to a substantial degree, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, give the *Contractor Notice in Writing*, containing particulars of the default including references to applicable provisions of the *Contract*, that the *Contractor* is in default of the *Contractor's* contractual obligations and instruct the *Contractor* to correct the default in the 5 *Working Days* immediately following the receipt of such *Notice in Writing*.
- 7.1.3 If the default cannot be corrected in the 5 *Working Days* specified or in such other time period as may be subsequently agreed in writing by the parties, the *Contractor* shall be in compliance with the *Owner's* instructions if the *Contractor*:
- .1 commences the correction of the default within the specified time,
 - .2 provides the *Owner* with an acceptable schedule for such correction, and
 - .3 corrects the default in accordance with the *Contract* terms and with such schedule.

- 7.1.4 If the *Contractor* fails to correct the default in the time specified or in such other time period as may be subsequently agreed in writing by the parties, without prejudice to any other right or remedy the *Owner* may have, the *Owner* may by giving *Notice in Writing*:
- .1 correct such default and deduct the cost thereof from any payment then or thereafter due the *Contractor* for the *Work* provided the *Consultant* has certified such cost to the *Owner* and the *Contractor*, or
 - .2 terminate the *Contractor*'s right to continue with the *Work* in whole or in part or terminate the *Contract*.
- 7.1.5 If the *Owner* terminates the *Contractor*'s right to continue with the *Work* as provided in paragraphs 7.1.1 and 7.1.4, the *Owner* shall be entitled to:
- .1 take possession of the *Work* and *Products* at the *Place of the Work*; subject to the rights of third parties, utilize the *Construction Equipment* at the *Place of the Work*; finish the *Work* by whatever method the *Owner* may consider expedient, but without undue delay or expense,
 - .2 withhold further payment to the *Contractor* until a final certificate for payment is issued,
 - .3 charge the *Contractor* the amount by which the full cost of finishing the *Work* as certified by the *Consultant*, including compensation to the *Consultant* for the *Consultant*'s additional services and a reasonable allowance as determined by the *Consultant* to cover the cost of corrections to work performed by the *Contractor* that may be required under GC 12.3 – WARRANTY, exceeds the unpaid balance of the *Contract Price*; however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference, and
 - .4 on expiry of the warranty period, charge the *Contractor* the amount by which the cost of corrections to the *Contractor*'s work under GC 12.3 – WARRANTY exceeds the allowance provided for such corrections, or if the cost of such corrections is less than the allowance, pay the *Contractor* the difference.
- 7.1.6 The *Contractor*'s obligation under the *Contract* as to quality, correction and warranty of the work performed by the *Contractor* up to the time of termination shall continue in force after such termination of the *Contract*.

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

- 7.2.1 If the *Owner* is adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Owner*'s insolvency, or if a receiver is appointed because of the *Owner*'s insolvency, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, terminate the *Contract* by giving the *Owner* or receiver or trustee in bankruptcy *Notice in Writing* to that effect.
- 7.2.2 If the *Work* is suspended or otherwise delayed for a period of 20 *Working Days* or more under an order of a court or other public authority and providing that such order was not issued as the result of an act or fault of the *Contractor* or of anyone directly or indirectly employed or engaged by the *Contractor*, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, terminate the *Contract* by giving the *Owner* *Notice in Writing* to that effect.
- 7.2.3 The *Contractor* may give *Notice in Writing* to the *Owner*, with a copy to the *Consultant*, that the *Owner* is in default of the *Owner*'s contractual obligations if:
- .1 the *Owner* fails to furnish, when so requested by the *Contractor*, reasonable evidence that financial arrangements have been made to fulfill the *Owner*'s obligations under the *Contract*,
 - .2 the *Consultant* fails to issue a certificate as provided in Part 5 of the General Conditions – PAYMENT,
 - .3 the *Owner* fails to pay the *Contractor* when due the amounts certified by the *Consultant* or awarded by adjudication, arbitration or court, or
 - .4 the *Owner* fails to comply with the requirements of the *Contract* to a substantial degree and the *Consultant*, except for GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER, gives a written statement to the *Owner* and the *Contractor* that provides detail of such failure to comply with the requirements of the *Contract* to a substantial degree.
- 7.2.4 The *Contractor*'s *Notice in Writing* to the *Owner* provided under paragraph 7.2.3 shall advise that if the default is not corrected within 5 *Working Days* following the receipt of the *Notice in Writing*, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, suspend the *Work* or terminate the *Contract*.
- 7.2.5 If the *Contractor* terminates the *Contract* by giving a *Notice in Writing* to the *Owner* under the conditions set out above, the *Contractor* shall be entitled to be paid for all work performed including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*.

PART 8 DISPUTE RESOLUTION

GC 8.1 AUTHORITY OF THE CONSULTANT

- 8.1.1 Differences between the parties to the *Contract* as to the interpretation, application or administration of the *Contract* or any failure to agree where agreement between the parties is called for, herein collectively called disputes, which are not resolved

in the first instance by findings of the *Consultant* as provided in GC 2.2 – ROLE OF THE CONSULTANT, shall be settled in accordance with the requirements of Part 8 of the General Conditions – DISPUTE RESOLUTION.

- 8.1.2 If a dispute arises under the *Contract* in respect of a matter in which the *Consultant* has no authority under the *Contract* to make a finding, the procedures set out in paragraph 8.1.3 and paragraphs 8.3.3 to 8.3.8 of GC 8.3 – NEGOTIATION, MEDIATION AND ARBITRATION, and in GC 8.4 – RETENTION OF RIGHTS apply to that dispute with the necessary changes to detail as may be required.
- 8.1.3 If a dispute is not resolved promptly, the *Consultant* will give such instructions as in the *Consultant's* opinion are necessary for the proper performance of the *Work* and to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by so doing neither party will jeopardize any claim the party may have. If it is subsequently determined that such instructions were in error or at variance with the *Contract Documents*, the *Owner* shall pay the *Contractor* costs incurred by the *Contractor* in carrying out such instructions which the *Contractor* was required to do beyond what the *Contract Documents* correctly understood and interpreted would have required, including costs resulting from interruption of the *Work*.

GC 8.2 ADJUDICATION

- 8.2.1 Nothing in this *Contract* shall be deemed to affect the rights of the parties to resolve any dispute by adjudication as may be prescribed by applicable legislation.

GC 8.3 NEGOTIATION, MEDIATION AND ARBITRATION

- 8.3.1 In accordance with the rules for mediation as provided in CCDC 40 'Rules for Mediation and Arbitration of Construction Industry Disputes' in effect at the time of bid closing, the parties shall appoint a Project Mediator
- .1 within 20 *Working Days* after the *Contract* was awarded, or
 - .2 if the parties neglected to make an appointment within the 20 *Working Days*, within 10 *Working Days* after either party by *Notice in Writing* requests that the Project Mediator be appointed.
- 8.3.2 A party shall be conclusively deemed to have accepted a finding of the *Consultant* under GC 2.2 – ROLE OF THE CONSULTANT and to have expressly waived and released the other party from any claims in respect of the particular matter dealt with in that finding unless, within 15 *Working Days* after receipt of that finding, the party sends a *Notice in Writing* of dispute to the other party and to the *Consultant*, which contains the particulars of the matter in dispute and the relevant provisions of the *Contract Documents*. The responding party shall send a *Notice in Writing* of reply to the dispute within 10 *Working Days* after receipt of such *Notice in Writing* setting out particulars of this response and any relevant provisions of the *Contract Documents*.
- 8.3.3 The parties shall make all reasonable efforts to resolve their dispute by amicable negotiations and agree to provide, without prejudice, frank, candid, and timely disclosure of relevant facts, information and documents to facilitate these negotiations.
- 8.3.4 After a period of 10 *Working Days* following receipt of a responding party's *Notice in Writing* of reply under paragraph 8.3.2, the parties shall request the Project Mediator to assist the parties to reach agreement on any unresolved dispute. The mediated negotiations shall be conducted in accordance with the rules for mediation as provided in CCDC 40 in effect at the time of bid closing.
- 8.3.5 If the dispute has not been resolved at the mediation or within such further period as is agreed by the parties, the Project Mediator will terminate the mediated negotiations by giving *Notice in Writing* to the *Owner*, the *Contractor* and the *Consultant*.
- 8.3.6 By giving a *Notice in Writing* to the other party and the *Consultant*, not later than 10 *Working Days* after the date of termination of the mediated negotiations under paragraph 8.3.5, either party may refer the dispute to be finally resolved by arbitration under the rules of arbitration as provided in CCDC 40 in effect at the time of bid closing. The arbitration shall be conducted in the jurisdiction of the *Place of the Work*.
- 8.3.7 On expiration of the 10 *Working Days*, the arbitration agreement under paragraph 8.3.6 is not binding on the parties and, if a *Notice in Writing* is not given under paragraph 8.3.6 within the required time, the parties may refer the unresolved dispute to the courts or to any other form of dispute resolution, including arbitration, which they have agreed to use.
- 8.3.8 If neither party, by *Notice in Writing*, given within 10 *Working Days* of the date of *Notice in Writing* requesting arbitration in paragraph 8.3.6, requires that a dispute be arbitrated immediately, all disputes referred to arbitration as provided in paragraph 8.3.6 shall be:
- .1 held in abeyance until:
 - (1) *Ready-for-Takeover*,
 - (2) the *Contract* has been terminated, or
 - (3) the *Contractor* has abandoned the *Work*,
 whichever is earlier; and

- .2 consolidated into a single arbitration under the rules governing the arbitration under paragraph 8.3.6.

GC 8.4 RETENTION OF RIGHTS

- 8.4.1 It is agreed that no act by either party shall be construed as a renunciation or waiver of any rights or recourses, provided the party has given the *Notice in Writing* required under Part 8 of the General Conditions – DISPUTE RESOLUTION and has carried out the instructions as provided in paragraph 8.1.3 of GC 8.1 – AUTHORITY OF THE CONSULTANT.
- 8.4.2 Nothing in Part 8 of the General Conditions – DISPUTE RESOLUTION shall be construed in any way to limit a party from asserting any statutory right to a lien under applicable lien legislation of the jurisdiction of the *Place of the Work* and the assertion of such right by initiating judicial proceedings is not to be construed as a waiver of any right that party may have under paragraph 8.3.6 of GC 8.3 – NEGOTIATION, MEDIATION AND ARBITRATION to proceed by way of arbitration to adjudicate the merits of the claim upon which such a lien is based.

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.1 PROTECTION OF WORK AND PROPERTY

- 9.1.1 The *Contractor* shall protect the *Work*, the *Owner's* property and property adjacent to the *Place of the Work* from damage which may arise as the result of the *Contractor's* operations under the *Contract*, and shall be responsible for such damage, except damage which occurs as the result of:
- .1 errors or omissions in the *Contract Documents*; or
 - .2 acts or omissions by the *Owner*, the *Consultant*, *Other Contractors*, or their agents and employees.
- 9.1.2 Before commencing any work, the *Contractor* shall determine the location of all underground utilities and structures indicated in the *Contract Documents* or that are reasonably apparent in an inspection of the *Place of the Work*.
- 9.1.3 Should the *Contractor* in the performance of the *Contract* damage the *Work*, the *Owner's* property or property adjacent to the *Place of the Work*, the *Contractor* shall be responsible for making good such damage at the *Contractor's* expense.
- 9.1.4 Should damage occur to the *Work* or the *Owner's* property for which the *Contractor* is not responsible, as provided in paragraph 9.1.1, the *Contractor* shall make good such damage to the *Work* and, if the *Owner* so directs, to the *Owner's* property. The *Contract Price* and *Contract Time* shall be adjusted as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

- 9.2.1 For the purposes of applicable legislation related to toxic and hazardous substances, the *Owner* shall be deemed to have control and management of the *Place of the Work* with respect to existing conditions.
- 9.2.2 Prior to the *Contractor* commencing the *Work*, the *Owner* shall,
- .1 take all reasonable steps to determine whether any toxic or hazardous substances are present at the *Place of the Work*, and
 - .2 provide the *Consultant* and the *Contractor* with a written list of any such substances that are known to exist and their locations.
- 9.2.3 The *Owner* shall take all reasonable steps to ensure that no person's exposure to any toxic or hazardous substance exceeds the time weighted levels prescribed by applicable legislation at the *Place of the Work* and that no property is damaged or destroyed as a result of exposure to, or the presence of, toxic or hazardous substances which were at the *Place of the Work* prior to the *Contractor* commencing the *Work*.
- 9.2.4 Unless the *Contract* expressly provides otherwise, the *Owner* shall be responsible for taking all necessary steps, in accordance with applicable legislation in force at the *Place of the Work*, to dispose of, store or otherwise render harmless any toxic or hazardous substance which was present at the *Place of the Work* prior to the *Contractor* commencing the *Work*.
- 9.2.5 If the *Contractor*
- .1 encounters toxic or hazardous substances at the *Place of the Work*, or
 - .2 has reasonable grounds to believe that toxic or hazardous substances are present at the *Place of the Work*, which were not brought to the *Place of the Work* by the *Contractor* or anyone for whom the *Contractor* is responsible and which were not disclosed by the *Owner* or which were disclosed but have not been dealt with as required under paragraph 9.2.4, the *Contractor* shall
 - .3 take all reasonable steps, including stopping the *Work*, to ensure that no person's exposure to any toxic or hazardous substance exceeds any applicable time weighted levels prescribed by applicable legislation at the *Place of the Work*, and
 - .4 immediately report the circumstances to the *Consultant* and the *Owner* in writing.

- 9.2.6 If the *Owner* and the *Contractor* do not agree on the existence, significance of, or whether the toxic or hazardous substances were brought onto the *Place of the Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, the *Owner* shall retain and pay for an independent qualified expert to investigate and determine such matters. The expert's report shall be delivered to the *Owner* and the *Contractor*.
- 9.2.7 If the *Owner* and the *Contractor* agree or if the expert referred to in paragraph 9.2.6 determines that the toxic or hazardous substances were not brought onto the place of the *Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, the *Owner* shall promptly at the *Owner's* own expense:
- .1 take all steps as required under paragraph 9.2.4;
 - .2 reimburse the *Contractor* for the costs of all steps taken pursuant to paragraph 9.2.5;
 - .3 extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor* and the expert referred to in 9.2.6 and reimburse the *Contractor* for reasonable costs incurred as a result of the delay; and
 - .4 indemnify the *Contractor* as required by GC 13.1 – INDEMNIFICATION.
- 9.2.8 If the *Owner* and the *Contractor* agree or if the expert referred to in paragraph 9.2.6 determines that the toxic or hazardous substances were brought onto the place of the *Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, the *Contractor* shall promptly at the *Contractor's* own expense:
- .1 take all necessary steps, in accordance with applicable legislation in force at the *Place of the Work*, to safely remove and dispose the toxic or hazardous substances;
 - .2 make good any damage to the *Work*, the *Owner's* property or property adjacent to the place of the *Work* as provided in paragraph 9.1.3 of GC 9.1 – PROTECTION OF WORK AND PROPERTY;
 - .3 reimburse the *Owner* for reasonable costs incurred under paragraph 9.2.6; and
 - .4 indemnify the *Owner* as required by GC 13.1 – INDEMNIFICATION.
- 9.2.9 If either party does not accept the expert's findings under paragraph 9.2.6, the disagreement shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION. If such disagreement is not resolved promptly, the parties shall act immediately in accordance with the expert's determination and take the steps required by paragraph 9.2.7 or 9.2.8 it being understood that by so doing, neither party will jeopardize any claim that party may have to be reimbursed as provided by GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES.

GC 9.3 ARTIFACTS AND FOSSILS

- 9.3.1 Fossils, coins, articles of value or antiquity, structures and other remains or things of scientific or historic interest discovered at the *Place or Work* shall, as between the *Owner* and the *Contractor*, be deemed to be the absolute property of the *Owner*.
- 9.3.2 The *Contractor* shall take all reasonable precautions to prevent removal or damage to discoveries as identified in paragraph 9.3.1, and shall advise the *Consultant* upon discovery of such items.
- 9.3.3 The *Consultant* will investigate the impact on the *Work* of the discoveries identified in paragraph 9.3.1. If conditions are found that would cause an increase or decrease in the *Contractor's* cost or time to perform the *Work*, the *Owner*, through the *Consultant*, shall issue appropriate instructions for a change in the *Work* as provided in GC 6.2 – CHANGE ORDER or GC 6.3 – CHANGE DIRECTIVE.

GC 9.4 CONSTRUCTION SAFETY

- 9.4.1 The *Contractor* shall be responsible for establishing, initiating, maintaining, and supervising all health and safety precautions and programs in connection with the performance of the *Work* in accordance with the applicable health and safety legislation.
- 9.4.2 The *Owner* and the *Contractor* shall comply with all health and safety precautions and programs established at the *Place of the Work*.
- 9.4.3 The *Owner* and the *Contractor* shall comply with the rules, regulations and practices required by the applicable health and safety legislation.
- 9.4.4 The *Owner* shall cause the *Consultant*, *Other Contractors* and the *Owner's* own forces to comply with all health and safety precautions and programs established by the *Contractor* at the *Place of the Work*.
- 9.4.5 Nothing in this *Contract* shall affect the determination of liability under the applicable health and safety legislation.

GC 9.5 MOULD

- 9.5.1 If the *Contractor* or the *Owner* observes or reasonably suspects the presence of mould at the *Place of the Work*, the remediation of which is not expressly part of the *Work*,
- .1 the observing party shall promptly report the circumstances to the other party in writing,
 - .2 the *Contractor* shall promptly take all reasonable steps, including stopping the *Work* if necessary, to ensure that no person suffers injury, sickness or death and that no property is damaged as a result of exposure to or the presence of the mould, and

- .3 if the *Owner* and the *Contractor* do not agree on the existence, significance or cause of the mould or as to what steps need be taken to deal with it, the *Owner* shall retain and pay for an independent qualified expert to investigate and determine such matters. The expert's report shall be delivered to the *Owner* and the *Contractor*.
- 9.5.2 If the *Owner* and the *Contractor* agree, or if the expert referred to in paragraph 9.5.1.3 determines that the presence of mould was caused by the *Contractor*'s operations under the *Contract*, the *Contractor* shall promptly, at the *Contractor*'s own expense:
- .1 take all reasonable and necessary steps to safely remediate or dispose of the mould,
 - .2 make good any damage to the *Work*, the *Owner*'s property or property adjacent to the *Place of the Work* as provided in paragraph 9.1.3 of GC 9.1 – PROTECTION OF WORK AND PROPERTY,
 - .3 reimburse the *Owner* for reasonable costs incurred under paragraph 9.5.1.3, and
 - .4 indemnify the *Owner* as required by GC 13.1 – INDEMNIFICATION.
- 9.5.3 If the *Owner* and the *Contractor* agree, or if the expert referred to in paragraph 9.5.1.3 determines that the presence of mould was not caused by the *Contractor*'s operations under the *Contract*, the *Owner* shall promptly, at the *Owner*'s own expense:
- .1 take all reasonable and necessary steps to safely remediate or dispose of the mould,
 - .2 reimburse the *Contractor* for the cost of taking the steps under paragraph 9.5.1.2 and making good any damage to the *Work* as provided in paragraph 9.1.4 of GC 9.1 – PROTECTION OF WORK AND PROPERTY,
 - .3 extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor* and the expert referred to in paragraph 9.5.1.3 and reimburse the *Contractor* for reasonable costs incurred as a result of the delay, and
 - .4 indemnify the *Contractor* as required by GC 13.1 – INDEMNIFICATION.
- 9.5.4 If either party does not accept the expert's finding under paragraph 9.5.1.3, the disagreement shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION. If such disagreement is not resolved promptly, the parties shall act immediately in accordance with the expert's determination and take the steps required by paragraphs 9.5.2 or 9.5.3, it being understood that by so doing neither party will jeopardize any claim the party may have to be reimbursed as provided by GC 9.5 – MOULD.

PART 10 GOVERNING REGULATIONS

GC 10.1 TAXES AND DUTIES

- 10.1.1 The *Contract Price* shall include all taxes and customs duties in effect at the time of the bid closing except for *Value Added Taxes* payable by the *Owner* to the *Contractor* as stipulated in Article A-4 of the Agreement – CONTRACT PRICE.
- 10.1.2 Any increase or decrease in costs to the *Contractor* due to changes in taxes and duties after the time of the bid closing shall increase or decrease the *Contract Price* accordingly.

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

- 10.2.1 The laws of the *Place of the Work* shall govern the *Work*.
- 10.2.2 The *Owner* shall obtain and pay for development approvals, building permit, permanent easements, rights of servitude, and all other necessary approvals and permits, except for the permits and fees referred to in paragraph 10.2.3 or for which the *Contract Documents* specify as the responsibility of the *Contractor*.
- 10.2.3 The *Contractor* shall be responsible for the procurement of permits, licences, inspections, and certificates, which are necessary for the performance of the *Work* and customarily obtained by contractors in the jurisdiction of the *Place of the Work* after the issuance of the building permit. The *Contract Price* includes the cost of these permits, licences, inspections, and certificates, and their procurement.
- 10.2.4 The *Contractor* shall give the required notices and comply with the laws, ordinances, rules, regulations, or codes which are or become in force during the performance of the *Work* and which relate to the *Work*, to the preservation of the public health, and to construction safety.
- 10.2.5 The *Contractor* shall not be responsible for verifying that the *Contract Documents* are in compliance with the applicable laws, ordinances, rules, regulations, or codes relating to the *Work*. If the *Contract Documents* are at variance therewith, or if, subsequent to the time of bid closing, changes are made to the applicable laws, ordinances, rules, regulations, or codes which require modification to the *Contract Documents*, the *Contractor* shall advise the *Consultant* in writing requesting direction immediately upon such variance or change becoming known. The *Consultant* will issue the changes required to the *Contract Documents* as provided in GC 6.1 – OWNER'S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

- 10.2.6 If the *Contractor* fails to advise the *Consultant* in writing; fails to obtain direction as required in paragraph 10.2.5; and performs work knowing it to be contrary to any laws, ordinances, rules, regulations, or codes; the *Contractor* shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations, or codes.
- 10.2.7 If, subsequent to the time of bid closing, changes are made to applicable laws, ordinances, rules, regulations, or codes of authorities having jurisdiction which affect the cost of the *Work*, either party may submit a claim in accordance with the requirements of GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE.

GC 10.3 PATENT FEES

- 10.3.1 The *Contractor* shall pay the royalties and patent licence fees required for the performance of the *Contract*. The *Contractor* shall hold the *Owner* harmless from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor*'s performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention by the *Contractor* or anyone for whose acts the *Contractor* may be liable.
- 10.3.2 The *Owner* shall hold the *Contractor* harmless against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor*'s performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention in executing anything for the purpose of the *Contract*, the physical model, plan or design of which was supplied to the *Contractor* as part of the *Contract*.

GC 10.4 WORKERS' COMPENSATION

- 10.4.1 Prior to commencing the *Work*, and again with the *Contractor*'s applications for payment, the *Contractor* shall provide evidence of compliance with workers' compensation legislation at the *Place of the Work*.

PART 11 INSURANCE

GC 11.1 INSURANCE

- 11.1.1 Without restricting the generality of GC 13.1 – INDEMNIFICATION, the *Contractor* shall provide, maintain and pay for the following insurance coverages, the requirements of which are specified in CCDC 41 'CCDC Insurance Requirements' in effect at the time of bid closing except as hereinafter provided:
- .1 General liability insurance in the name of the *Contractor* and include, or in the case of a single, blanket policy, be endorsed to name, the *Owner* and the *Consultant* as insureds but only with respect to liability, other than legal liability arising out of their sole negligence, arising out of the operations of the *Contractor* with regard to the *Work*. General liability insurance shall be maintained from the date of commencement of the *Work* until one year from the date of *Ready-for-Takeover*. Liability coverage shall be provided for completed operations hazards from the date of *Ready-for-Takeover* on an ongoing basis for a period of 6 years following *Ready-for-Takeover*.
 - .2 Automobile Liability Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.
 - .3 Unmanned aerial vehicle aircraft, manned aircraft or watercraft Liability Insurance when owned or non-owned manned or unmanned aircraft or watercraft are used directly or indirectly in the performance of the *Work*.
 - .4 "Broad form" property insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. The "Broad form" property insurance shall be provided from the date of commencement of the *Work* until the earliest of:
 - (1) 10 calendar days after the date of *Ready-for-Takeover*;
 - (2) on the commencement of use or occupancy of any part or section of the *Work* unless such use or occupancy is for construction purposes, habitational, office, banking, convenience store under 465 square metres in area, or parking purposes, or for the installation, testing and commissioning of equipment forming part of the *Work*; and
 - (3) when left unattended for more than 30 consecutive calendar days or when construction activity has ceased for more than 30 consecutive calendar days.
 - .5 Boiler and machinery insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. The coverage shall be maintained continuously from commencement of use or operation of the boiler and machinery objects insured by the policy and until 10 calendar days after the date of *Ready-for-Takeover*.
 - .6 The "Broad form" property and boiler and machinery policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. In the event of loss or damage:
 - (1) the *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except

that the *Contractor* shall be entitled to such reasonable extension of *Contract Time* relative to the extent of the loss or damage as the *Consultant* may recommend in consultation with the *Contractor*;

- (2) the *Contractor* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount which the *Owner's* interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds in accordance with the progress payment provisions. In addition the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor's* interest in the restoration of the *Work*; and
- (3) to the *Work* arising from the work of the *Owner*, the *Owner's* own forces or *Other Contractors*, the *Owner* shall, in accordance with the *Owner's* obligations under the provisions relating to construction by the *Owner* or *Other Contractors*, pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as in accordance with the progress payment provisions.

- .7 *Contractors' Equipment Insurance* from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.
- .8 *Contractors' Pollution Liability Insurance* from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.

- 11.1.2 Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements applicable to the *Work*.
- 11.1.3 The parties shall pay their share of the deductible amounts in direct proportion to their responsibility in regards to any loss for which the above policies are required to pay, except where such amounts may be excluded by the terms of the *Contract*.
- 11.1.4 If the *Contractor* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and give evidence to the *Contractor* and the *Consultant*. The *Contractor* shall pay the cost thereof to the *Owner* on demand or the *Owner* may deduct the cost from the amount which is due or may become due to the *Contractor*.
- 11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the *Place of the Work*.
- 11.1.6 If a revised version of CCDC 41 is published, which specifies reduced insurance requirements, the parties shall address such reduction, prior to the *Contractor's* insurance policy becoming due for renewal, and record any agreement in a *Change Order*.
- 11.1.7 If a revised version of CCDC 41 is published, which specifies increased insurance requirements, the *Owner* may request the increased coverage from the *Contractor* by way of a *Change Order*.
- 11.1.8 A *Change Directive* shall not be used to direct a change in the insurance requirements in response to the revision of CCDC 41.

PART 12 OWNER TAKEOVER

GC 12.1 READY-FOR-TAKEOVER

- 12.1.1 The prerequisites to attaining *Ready-for-Takeover* of the *Work* are limited to the following:
 - .1 The *Consultant* has certified or verified the *Substantial Performance of the Work*.
 - .2 Evidence of compliance with the requirements for occupancy or occupancy permit as prescribed by the authorities having jurisdiction.
 - .3 Final cleaning and waste removal at the time of applying for *Ready-for-Takeover*, as required by the *Contract Documents*.
 - .4 The delivery to the *Owner* of such operations and maintenance documents reasonably necessary for immediate operation and maintenance, as required by the *Contract Documents*.
 - .5 Make available a copy of the as-built drawings completed to date on site.
 - .6 Startup, testing required for immediate occupancy, as required by the *Contract Documents*.
 - .7 Ability to secure access to the *Work* has been provided to the *Owner*, if required by the *Contract Documents*.
 - .8 Demonstration and training, as required by the *Contract Documents*, is scheduled by the *Contractor* acting reasonably.
- 12.1.2 If any prerequisites set forth in paragraphs 12.1.1.3 to 12.1.1.6 must be deferred because of conditions reasonably beyond the control of the *Contractor*, or by agreement between the *Owner* and the *Contractor* to do so, *Ready-for-Takeover* shall not be delayed.
- 12.1.3 When the *Contractor* considers that the *Work* is *Ready-for-Takeover*, the *Contractor* shall deliver to the *Consultant* and to the *Owner* a comprehensive list of items to be completed or corrected, together with a written application for *Ready-for-Takeover* for review. Failure to include an item on the list does not alter the responsibility of the *Contractor* to complete the *Contract*.
- 12.1.4 The *Consultant* will review the *Work* to verify the validity of the application and will promptly, and in any event, no later than 10 calendar days after receipt of the *Contractor's* list and application:

- .1 advise the *Contractor* in writing that the *Work* is not *Ready-for-Takeover* and give reasons why, or
- .2 confirm the date of *Ready-for-Takeover* in writing to each of the *Owner* and the *Contractor*.

12.1.5 Immediately following the confirmation of the date of *Ready-for-Takeover*, the *Contractor*, in consultation with the *Consultant*, shall establish a reasonable date for finishing the *Work*.

12.1.6 The provision of GC 12.1 – READY-FOR-TAKEOVER shall be subject to GC 12.2 – EARLY OCCUPANCY BY THE OWNER.

GC 12.2 EARLY OCCUPANCY BY THE OWNER

12.2.1 The *Owner* may take occupancy of a part or the entirety of the *Work* before *Ready-for-Takeover* has been attained only as agreed by the *Contractor* which agreement shall not be unreasonably withheld.

12.2.2 The *Owner* shall not occupy a part or the entirety of the *Work* without prior approval by authorities having jurisdiction.

12.2.3 If the *Owner* takes occupancy of a part of the *Work* before *Ready-for-Takeover* has been attained:

- .1 The part of the *Work* which is occupied shall be deemed to have been taken over by the *Owner* as from the date on which it is occupied.
- .2 The *Contractor* shall cease to be liable for the care of such part as from this date, when responsibility shall pass to the *Owner*.
- .3 The warranty period specified in paragraph 12.3.1 of GC 12.3 – WARRANTY for that part of the *Work* shall start from the date on which it is occupied.

12.2.4 If the *Owner* takes occupancy of the entirety of the *Work* before all the prerequisites are met as described in paragraph 12.1.1 of GC 12.1 – READY-FOR-TAKEOVER, the *Work* shall, subject to the requirements of the applicable lien legislation, be deemed to achieve *Ready-for-Takeover*. This shall not relieve the *Contractor*'s responsibility to complete the *Work* in a timely manner.

GC 12.3 WARRANTY

12.3.1 Except for extended warranties as described in paragraph 12.3.6, the warranty period under the *Contract* is one year from the date when *Ready-for-Takeover* has been attained.

12.3.2 The *Contractor* shall be responsible for the proper performance of the *Work* to the extent that the design and *Contract Documents* permit such performance.

12.3.3 The *Owner*, through the *Consultant*, shall promptly give the *Contractor Notice in Writing* of observed defects and deficiencies which occur during the one year warranty period.

12.3.4 Subject to paragraph 12.3.2, the *Contractor* shall correct promptly, at the *Contractor*'s expense, defects or deficiencies in the *Work* which appear prior to and during the one year warranty period.

12.3.5 The *Contractor* shall correct or pay for damage resulting from corrections made under the requirements of paragraph 12.3.4.

12.3.6 Any extended warranties required beyond the one year warranty period as described in paragraph 12.3.1, shall be as specified in the *Contract Documents*. Extended warranties shall be issued by the warrantor to the benefit of the *Owner*. The *Contractor*'s responsibility with respect to extended warranties shall be limited to obtaining any such extended warranties from the warrantor. The obligations under such extended warranties are solely the responsibilities of the warrantor.

PART 13 INDEMNIFICATION AND WAIVER

GC 13.1 INDEMNIFICATION

13.1.1 Without restricting the parties' obligation to indemnify respecting toxic and hazardous substances, patent fees and defect in title claims all as described in paragraphs 13.1.4 and 13.1.5, the *Owner* and the *Contractor* shall each indemnify and hold harmless the other from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings whether in respect to losses suffered by them or in respect to claims by third parties that arise out of, or are attributable in any respect to their involvement as parties to this *Contract*, provided such claims are:

- .1 caused by:
 - (1) the negligent acts or omissions of the party from whom indemnification is sought or anyone for whose negligent acts or omissions that party is liable, or
 - (2) a failure of the party to the *Contract* from whom indemnification is sought to fulfill its terms or conditions; and
- .2 made by *Notice in Writing* within a period of 6 years from the *Ready-for-Takeover* date or within such shorter period as may be prescribed by any limitation statute of the Province or Territory of the *Place of the Work*.

The parties expressly waive the right to indemnity for claims other than those provided for in this *Contract*.

- 13.1.2 The obligation of either party to indemnify as set forth in paragraph 13.1.1 shall be limited as follows:
- .1 In respect to losses suffered by the *Owner* and the *Contractor* for which insurance is to be provided by either party pursuant to GC 11.1 – INSURANCE, the minimum liability insurance limit for one occurrence, of the applicable insurance policy, as referred to in CCDC 41 in effect at the time of bid closing.
 - .2 In respect to losses suffered by the *Owner* and the *Contractor* for which insurance is not required to be provided by either party in accordance with GC 11.1 – INSURANCE, the greater of the *Contract Price* as recorded in Article A-4 – CONTRACT PRICE or \$2,000,000, but in no event shall the sum be greater than \$20,000,000.
 - .3 In respect to indemnification by a party against the other with respect to losses suffered by them, such obligation shall be restricted to direct loss and damage, and neither party shall have any liability to the other for indirect, consequential, punitive or exemplary damages.
 - .4 In respect to indemnification respecting claims by third parties, the obligation to indemnify is without limit.
- 13.1.3 The obligation of either party to indemnify the other as set forth in paragraphs 13.1.1 and 13.1.2 shall be inclusive of interest and all legal costs.
- 13.1.4 The *Owner* and the *Contractor* shall indemnify and hold harmless the other from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of their obligations described in GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES.
- 13.1.5 The *Owner* shall indemnify and hold harmless the *Contractor* from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings:
- .1 as described in paragraph 10.3.2 of GC 10.3 – PATENT FEES, and
 - .2 arising out of the *Contractor*'s performance of the *Contract* which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the *Place of the Work*.
- 13.1.6 In respect to any claim for indemnity or to be held harmless by the *Owner* or the *Contractor*:
- .1 *Notice in Writing* of such claim shall be given within a reasonable time after the facts upon which such claim is based become known; and
 - .2 should any party be required as a result of its obligation to indemnify another to pay or satisfy a final order, judgment or award made against the party entitled by this contract to be indemnified, then the indemnifying party upon assuming all liability for any costs that might result shall have the right to appeal in the name of the party against whom such final order or judgment has been made until such rights of appeal have been exhausted.

GC 13.2 WAIVER OF CLAIMS

- 13.2.1 Subject to any lien legislation applicable to the *Place of the Work*, the *Contractor* waives and releases the *Owner* from all claims which the *Contractor* has or reasonably ought to have knowledge of that could be advanced by the *Contractor* against the *Owner* under the *Contract*, including, without limitation, those arising from negligence or breach of contract in respect to which the cause of action is based upon acts or omissions which occurred prior to or on the *Ready-for-Takeover* date, except as follows:
- .1 claims arising prior to or on the *Ready-for-Takeover* date for which *Notice in Writing* of claim has been received by the *Owner* from the *Contractor* no later than 5 calendar days before the expiry of the lien period provided by the lien legislation applicable at the *Place of the Work* or 20 calendar days following the *Ready-for-Takeover* date, whichever is later;
 - .2 indemnification for claims advanced against the *Contractor* by third parties for which a right of indemnification may be asserted by the *Contractor* against the *Owner* pursuant to the provisions of this *Contract*;
 - .3 claims respecting toxic and hazardous substances, patent fees and defect in title matters for which a right of indemnity could be asserted by the *Contractor* pursuant to the provisions of paragraphs 13.1.4 or 13.1.5 of GC 13.1 – INDEMNIFICATION; and
 - .4 claims resulting from acts or omissions which occur after the *Ready-for-Takeover* date.
- 13.2.2 The *Contractor* waives and releases the *Owner* from all claims resulting from acts or omissions which occurred after the *Ready-for-Takeover* date except for:
- .1 indemnification respecting third party claims, and claims respecting toxic and hazardous substances, patent fees and defect in title matters, all as referred in paragraphs 13.2.1.2 and 13.2.1.3; and
 - .2 claims for which *Notice in Writing* of claim has been received by the *Owner* from the *Contractor* within 395 calendar days following the *Ready-for-Takeover* date.
- 13.2.3 Subject to any lien legislation applicable to the *Place of the Work*, the *Owner* waives and releases the *Contractor* from all claims which the *Owner* has or reasonably ought to have knowledge of that could be advanced by the *Owner* against the *Contractor* under the *Contract*, including, without limitation, those arising from negligence or breach of contract in respect to which the cause of action is based upon acts or omissions which occurred prior to or on the *Ready-for-Takeover* date, except as follows:
- .1 claims arising prior to or on the *Ready-for-Takeover* date for which *Notice in Writing* of claim has been received by the *Contractor* from the *Owner* no later than 20 calendar days following the *Ready-for-Takeover* date;

- .2 indemnification for claims advanced against the *Owner* by third parties for which a right of indemnification may be asserted by the *Owner* against the *Contractor* pursuant to the provisions of this *Contract*;
 - .3 claims respecting toxic and hazardous substances for which a right of indemnity could be asserted by the *Owner* against the *Contractor* pursuant to the provisions of paragraph 13.1.4 of GC 13.1 – INDEMNIFICATION;
 - .4 damages arising from the *Contractor*'s actions which result in substantial defects or deficiencies in the *Work*. "Substantial defects or deficiencies" mean those defects or deficiencies in the *Work* which affect the *Work* to such an extent or in such a manner that a significant part or the whole of the *Work* is unfit for the purpose intended by the *Contract Documents*;
 - .5 claims arising pursuant to GC 12.3 – WARRANTY; and
 - .6 claims arising from acts or omissions which occur after the *Ready-for-Takeover* date.
- 13.2.4 Respecting claims arising upon substantial defects and deficiencies in the *Work*, as referenced in paragraph 13.2.3.4, and notwithstanding paragraph 13.2.3.5, the *Owner* waives and releases the *Contractor* from all claims except claims for which *Notice in Writing* of claim has been received by the *Contractor* from the *Owner* within a period of six years from the *Ready-for-Takeover* date, provided that any limitation statute of the Province or Territory of the *Place of the Work* permit such agreement. If the applicable limitation statute does not permit such agreement, the time within which any such claim may be brought shall be such shorter period as may be prescribed by any limitation statute of the Province or Territory of the *Place of the Work*.
- 13.2.5 The *Owner* waives and releases the *Contractor* from all claims arising from acts or omissions which occur after the *Ready-for-Takeover* date, except for:
- .1 indemnification for claims advanced against the *Owner* by third parties, as referenced in paragraph 13.2.3.2;
 - .2 claims respecting toxic and hazardous substances for which a right of indemnity could be asserted by the *Owner* against the *Contractor*, as referenced in paragraph 13.2.3.3;
 - .3 claims arising under GC 12.3 – WARRANTY; and
 - .4 claims for which *Notice in Writing* has been received by the *Contractor* from the *Owner* within 395 calendar days following the *Ready-for-Takeover* date.
- 13.2.6 "Notice in Writing of claim" as provided for in GC 13.2 – WAIVER OF CLAIMS to preserve a claim or right of action which would otherwise, by the provisions of GC 13.2 – WAIVER OF CLAIMS, be deemed to be waived, must include the following:
- .1 a clear and unequivocal statement of an intention to claim;
 - .2 a statement as to the nature of the claim and the grounds upon which the claim is based; and
 - .3 a statement of the estimated quantum of the claim.
- 13.2.7 A claim for lien asserted under the lien legislation prevailing at the *Place of the Work* shall qualify as notice of claim for the purposes of this *Contract*.
- 13.2.8 The party giving the *Notice in Writing* of claim as provided for in GC 13.2 – WAIVER OF CLAIMS shall submit within a reasonable time a detailed account of the amount claimed.
- 13.2.9 Where the event or series of events giving rise to a claim made under paragraphs 13.2.1 or 13.2.3 has a continuing effect, the detailed account submitted under paragraph 13.2.8 shall be considered to be an interim account and the party making the claim shall submit further interim accounts, at reasonable intervals, giving the accumulated amount of the claim and any further grounds upon which such claim is based. The party making the claim shall submit a final account after the end of the effects resulting from the event or series of events.
- 13.2.10 Nothing in GC 13.2 – WAIVER OF CLAIMS shall be deemed to affect the rights of the parties under any lien legislation or limitations legislation prevailing at the *Place of the Work*.

**SUPPLEMENTARY CONDITIONS
STANDARD CONSTRUCTION DOCUMENT – CCDC 2 –
2020 LAST UPDATED APRIL 2, 2026**

Contents

AGREEMENT BETWEEN OWNER AND CONTRACTOR

ARTICLE A-1 THE WORK

ARTICLE A-4 CONTRACT PRICE

ARTICLE A-5 PAYMENT

ARTICLE A-6 RECEIPT AND ADDRESSES FOR NOTICES IN WRITING

ARTICLE A-9 RELATIONSHIP OF THE PARTIES

ARTICLE A-10 PANDEMIC

ARTICLE A-11 INTERPRETATION AND OTHER MATTERS

DEFINITIONS

GENERAL CONDITIONS

GC 1.1 CONTRACT DOCUMENTS

GC 1.4 ASSIGNMENT

GC 2.2 ROLE OF THE CONSULTANT

GC 2.3 REVIEW AND INSPECTION OF THE WORK

GC 2.4 DEFECTIVE WORK

GC 2.5 OWNER’S AGENT

GC 3.1 CONTROL OF THE WORK

GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

GC 3.4 CONSTRUCTION SCHEDULE

GC 3.6 SUBCONTRACTORS AND SUPPLIERS

GC 3.7 LABOUR AND PRODUCTS

GC 3.8 SHOP DRAWINGS

GC 3.9 CLEAN-UP

GC 3.10 DOCUMENTS AT THE SITE

GC 3.11 USE OF THE WORK

GC 3.12 CUTTING AND REMEDIAL WORK

GC 3.13 EXCESS SOILS

GC 4.1 CASH ALLOWANCES PAYMENT

GC 4.2 CONTINGENCY ALLOWANCE

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

GC 5.2 APPLICATIONS FOR PAYMENT

GC 5.3 PAYMENT

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF
HOLDBACK

GC 5.5 FINAL PAYMENT

GC 5.8 SET-OFF

GC 6.2	CHANGE ORDER
GC 6.3	CHANGE DIRECTIVE
GC 6.4	CONCEALED OR UNKNOWN CONDITIONS
GC 6.5	DELAYS
GC 6.6	CLAIMS FOR A CHANGE IN CONTRACT PRICE
GC 7.1	OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, OR TERMINATE THE CONTRACT
GC 7.2	CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT
GC 7.3	TERMINATION FOR CONVENIENCE
GC 8.1	AUTHORITY OF THE CONSULTANT
GC 8.2	ADJUDICATION
GC 8.3	NEGOTIATION, MEDIATION AND ARBITRATION
GC 9.1	PROTECTION OF WORK AND PROPERTY
GC 9.2	TOXIC AND HAZARDOUS SUBSTANCES
GC 9.4	CONSTRUCTION SAFETY
GC 9.5	MOULD
GC 10.2	LAWS, NOTICES, PERMITS, AND FEES
GC 10.4	WORKERS' COMPENSATION
GC 11.1	INSURANCE
GC 11.2	CONTRACT SECURITY
GC 12.1	READY-FOR-TAKEOVER
GC 12.2	EARLY OCCUPANCY BY THE OWNER
GC 12.3	WARRANTY
GC 13.1	INDEMNIFICATION
GC 14.1	CONSTRUCTION LIENS
GC 15.1	OWNERSHIP AND CONFIDENTIALITY
GC 16.1	FREEDOM OF INFORMATION
GC 17.1	AODA REQUIREMENTS

APPENDIX 1 TO THE SUPPLEMENTARY CONDITIONS – AGREEMENT TERM SHEET

APPENDIX 2 TO THE SUPPLEMENTARY CONDITIONS – PROPER INVOICE REQUIREMENTS

Exhibit A To Appendix 2 To The Supplementary Conditions Proper Invoice Template

Exhibit B To Appendix 2 To The Supplementary Conditions Form Of Final Waiver And Release

APPENDIX 3 TO THE SUPPLEMENTARY CONDITIONS – INSURANCE

APPENDIX 4 TO THE SUPPLEMENTARY CONDITIONS – DESIGNATED WORKS

AGREEMENT BETWEEN OWNER AND CONTRACTOR

ARTICLE A-1 THE WORK

SC-1 Delete paragraph 1.3 of Article A-1 and replace it with the following:

“commence the *Work* by the date stipulated by the *Owner* in the *Notice of Award* and, subject to adjustment in *Contract Time* as provided for in the *Contract Documents*, attain *Ready-for-Takeover* and *Completion* in accordance with the *Agreement Term Sheet*.”

SC-2 Add the following new paragraphs 1.4 and 1.5 to Article A-1:

“1.4 The *Contractor* shall diligently perform and complete the *Work* in accordance with the *Standard of Care*, all *Applicable Laws* and all terms and conditions of the *Contract Documents*, including the *Construction Schedule*.

1.5 The *Contractor* represents that in entering into the *Contract* with the *Owner* for the performance of the *Work*, it has either in accordance with the *Standard of Care* inspected the *Place of the Work* and reviewed for itself all information provided by the *Owner*, the character of the *Work* to be done, and all local conditions, including the position of all registered easements, pole lines, conduits, watermains, sewers and other underground and overground utilities and structures, or that, not having so inspected and reviewed, the *Contractor* has assumed and does hereby assume all risk of conditions now existing or arising in the course of the *Work* that might or could make the *Work*, or any items thereof, more expensive in character, or more onerous to fulfil than was contemplated or known as of the *Effective Date*. For certainty, the *Contractor* shall not be liable for conditions which would not have been ascertainable by a diligent review of the *Place of the Work*, all information provided by the *Owner*, the character of the *Work* to be done, and all local conditions in accordance with the *Standard of Care* prior to the *Effective Date*.”

ARTICLE A-4 CONTRACT PRICE

SC-3 Add new paragraphs 4.6 and 4.7 to Article A-4 as follows:

“4.6 To secure performance of the *Contractor*’s warranty obligations the *Owner* shall retain from each *Proper Invoice* an amount equal to the percentage of the total amount claimed for payment in such *Proper Invoice* (exclusive of *Value Added Taxes*) as stipulated in the *Agreement Term Sheet* (the “***Warranty Security***”).

4.7 For the purposes of paragraph 6.5.7, if the *Contractor* fails to achieve *Ready-for-Takeover* by the *Ready-for-Takeover Date* then the *Contractor* shall be liable to the *Owner* for liquidated damages in the amount per day stipulated in the *Agreement Term Sheet* for each day or part day of delay until *Ready-for-Takeover* is achieved.”

ARTICLE A-5 PAYMENT

SC-4 Delete paragraphs 5.1 and 5.2 of Article A-5 in its entirety and replace it with the following:

“5.1 Subject to the provisions of the *Contract Documents* and *Payment Legislation*, including in accordance with statutory regulations respecting holdback percentages, the *Owner* shall:

- .1 make progress payments to the *Contractor* on account of the *Contract Price* (excluding the *Warranty Security*) when due together with such *Value Added Taxes* as may be applicable to such payments,
- .2 upon *Substantial Performance of the Work*, pay to the *Contractor* the unpaid balance of the holdback amount when due together with such *Value Added Taxes* as may be applicable to such payment,
- .3 upon *Completion*, pay to the *Contractor* the unpaid balance of the *Contract Price* (excluding the *Warranty Security* and any unauthorized cash allowances, contingencies and provisional items) when due together with such *Value Added Taxes* as may be applicable to such payment, and
- .4 upon the issuance of the *Proper Invoice* for payment of the *Warranty Security* (less any deductions to such security applied in accordance with this *Contract*) following satisfaction of all requirements set out in paragraph 12.3.8, pay the *Warranty Security* when due together with such *Value Added Taxes* as may be applicable to such payment.

For certainty, all payments made by the *Owner* pursuant to subparagraphs 5.1.1, 5.1.2 and 5.1.3 shall be exclusive of the *Warranty Security*, which amount shall be paid as a milestone payment in accordance with subparagraph 5.1.4.

5.2 Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by adjudication, arbitration or court, interest shall also become due and payable at the rates stipulated in the *Payment Legislation*.”

ARTICLE A-6 RECEIPT AND ADDRESSES FOR NOTICES IN WRITING

SC-5 Delete paragraph 6.5 of Article A-6 in its entirety and replace it with the following:

“6.5 Contact information for a party may be changed by *Notice in Writing* to the other party setting out the new contact information in accordance with this Article A-6.”

ARTICLE A-9 RELATIONSHIP OF THE PARTIES**ARTICLE A-10 PANDEMIC****ARTICLE A-11 INTERPRETATION AND OTHER MATTERS**

SC-6 Add new Articles A-9, A-10, and A-11 as follows:

“ARTICLE A-9 RELATIONSHIP OF THE PARTIES

- 9.1 The *Contractor* shall be an independent contractor in performing its obligations under the *Contract*. The *Contract* does not create any agency, partnership, joint venture, fiduciary or other relationship of the *Contractor* with the *Owner* other than the relationship of independent contractor.
- 9.2 No inspection, review, comment, approval, verification, confirmation, certification, acknowledgement or audit pursuant to the provisions of the *Contract* by any *Owner Personnel*, nor any failure of any of them to do so, shall relieve the *Contractor* from performing or fulfilling any of its obligations under the *Contract* or be construed as an acceptance of the *Work* or any part thereof.”

ARTICLE A-10 PANDEMIC

- 10.1 The parties acknowledge and agree that as of the *Effective Date*:
- .1 the *Pandemic* is on-going and, as a result, *Governmental Authorities*, including the Government of Canada, the Province of Ontario, The Regional Municipality of Halton and the *Municipality*, have implemented *Governmental Responses*; and
 - .2 it is uncertain how long the *Pandemic* and the related *Governmental Responses* will continue and whether there may be a resurgence of *COVID-19* resulting in a *Pandemic Change in Law*.
- 10.2 Except as expressly provided in this *Contract*, each party shall be solely responsible for costs and expenses incurred in performance of its obligations under the *Contract* related to or arising from the *Pandemic* and compliance with *Governmental Responses*, including in respect of the contraction by or infection of *Contractor Personnel* and *Owner Personnel*, as applicable, with *COVID-19* and neither party assumes responsibility whatsoever with respect to any such loss suffered by the other.
- 10.3 In addition to any *Governmental Responses*, the *Contractor* shall comply with any other *Pandemic*-related protocols and guidelines pertaining to the *Work* or *Place of the Work* that may be communicated to the *Contractor* by the *Owner* in writing.
- 10.4 Notwithstanding any other term of this *Contract*, the *Owner* and *Contractor*

acknowledge and agree that under no circumstance shall any *Contractor Personnel* be obligated to provide or disclose the personal information of any *Contractor Personnel* to the *Owner* or any other third party.

- 10.5 The *Contractor* expressly acknowledges and agrees that the *Contract Price* and *Contract Time* account for and are inclusive of all costs and impacts to the *Work* resultant or arising from *COVID-19*, any *Governmental Response* and the *Pandemic* to the extent such costs and impacts were known as of the *Effective Date*. For certainty, the *Contractor* acknowledges and agrees that the following impacts of *COVID-19*, the *Pandemic* and *Governmental Responses* to performance of the *Work* were known as of the *Effective Date* and, accordingly, are fully accounted for in the *Contract Price* and *Contract Time*:
- .1 the best practices recommended by the Ontario Ministry of Labour for construction site health and safety during the *Pandemic* in effect at the date of the *Contract*;
 - .2 the need to implement physical distancing;
 - .3 the obligation to monitor workers, personnel and visitors to the *Place of the Work* for illness or *COVID-19* symptoms;
 - .4 the potential for loss of *Contractor Personnel* due to illness, *COVID-19* symptoms or exposure to Persons with same;
 - .5 the need to implement procedures for timely reporting (including to the *Owner*) of any illness or *COVID-19* symptoms experienced by workers, personnel or visitors to the *Place of the Work*;
 - .6 the provision of necessary tools, equipment or personal protective equipment to all persons at the *Place of the Work*, including all *Contractor Personnel* and authorized visitors to the *Place of the Work*;
 - .7 the need to install any temporary facilities or structures (such as wash stations); and
 - .8 the need to implement appropriate sanitation and cleaning at the *Place of the Work* and in performance of the *Work*.
- 10.6 The *Owner* reserves the right, in its sole discretion and by *Notice in Writing*, to delay commencement or suspend performance of the *Work*, as applicable, for such time as is reasonably necessary to mitigate or prevent risks to public health and safety resultant from *COVID-19* and the *Pandemic*. Performance of the *Work* by the *Contractor* shall be resumed upon the *Owner*'s provision of fifteen (15) days' written notice to the *Contractor*. The *Contract Time* shall be extended for such reasonable time as agreed by the *Owner* and *Contractor* and any reasonable costs related to the *Work* and directly incurred by the *Contractor* during any such period of delay shall be reimbursed by the *Owner*, except to

the extent required or caused by the negligence or breach of this *Contract* by any *Contractor Personnel*. The extension of time shall not be less than the time lost as a result of such delay, unless the *Contractor* agrees to a shorter extension. The parties' agreement regarding such adjustment to the *Contract Time* and reimbursement of reasonable costs shall be set out in a *Change Order*. Otherwise, any dispute in this regard shall be resolved in accordance with PART 8 – DISPUTE RESOLUTION.

- 10.7 Notwithstanding any other provision in the *Contract*, if the *Contractor* is delayed in performing or unable to perform the *Work* as a result of a *Pandemic Change in Law*, then, except to the extent caused by the negligence or breach of this *Contract* by any *Contractor Personnel*, the *Contract Time* shall be extended for such reasonable time as agreed by the *Owner* and *Contractor*. The extension of time shall not be less than the time lost as a result of the *Pandemic Change in Law*, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for any costs incurred as a result of such delays, save and except as expressly provided for in paragraph 10.8 of this Article A-10.
- 10.8 The *Contractor* shall be entitled to payment for the following direct costs it reasonably incurs as a direct result of a *Pandemic Change in Law* provided that such costs have been approved in advance and in writing by the *Owner* and were not required or caused by the negligence or breach of this *Contract* by any *Contractor Personnel*:
 - .1 the *Contractor* being required to purchase, use or provide additional safety-related supplies, including personal protective equipment, in connection with its performance of the *Work*;
 - .2 the *Contractor* being required to install additional temporary facilities or structures, including hand washing stations; and
 - .3 the costs incurred by the *Contractor* to reasonably mitigate the effect of any delay to performance of the *Work* resultant from a *Pandemic Change in Law*.
- 10.9 Notwithstanding any other term of this *Contract*:
 - .1 the *Contractor* shall not be entitled to any extension of *Contract Time* or to any compensation in respect of any *Pandemic Change in Law* or delay referred to in this Article A-10 to the extent such delay or costs resulted from the *Contractor's* failure to take reasonable steps to mitigate the effect of the delay or *Pandemic Change in Law*, as applicable;
 - .2 in no event shall the *Owner* be liable for any costs or damages incurred by the *Contractor* as a result of any *Pandemic Change in Law* or delay referred to in this Article A-10 except as expressly stipulated in this *Contract*, including no liability for: (i) any costs associated with increased labour or

material costs; (ii) any costs associated with supply chain impacts or delays; or (iii) any *Consequential Damages*;

.3 there will be no unjust enrichment from a *Pandemic Change in Law*.

- 10.10 In all cases where the *Contractor* considers itself entitled to an extension of the *Contract Time* or compensation as a result of *COVID-19*, the *Pandemic* or a *Pandemic Change in Law*, the *Contractor* shall provide the *Owner* with *Notice in Writing* within five (5) *Working Days* of the date on which the *Contractor* knew that it was so impacted. The *Contractor* shall keep detailed records of all resultant additional costs and schedule impacts and shall provide such records to the *Owner*, including with such *Notice in Writing* to the extent available at such time. Additionally, the *Contractor* shall seek the *Owner's* approval in writing in advance of taking any measures to mitigate the impact of *COVID-19*, the *Pandemic* or a *Pandemic Change in Law*.”

ARTICLE A-11 - INTERPRETATION AND OTHER MATTERS

- 11.1 In the *Contract Documents* the word “including” means “including without limitation”, and the word “includes” means “includes without limitation”.
- 11.2 If any provision of the *Contract* is determined to be invalid, illegal or unenforceable in whole or in part, such invalidity, illegality or unenforceability will only apply to such provision or part, as the case may be, and any other part and all other provisions of the *Contract* shall remain in full force and effect. Furthermore, the parties shall endeavour to agree on a provision which reflects insofar as reasonably possible the commercial intentions of the invalid, illegal or unenforceable provision or part.
- 11.3 Each party shall from time to time execute and deliver all such further documents and instruments and do all acts and things as the other party may reasonably require to effectively carry out, better evidence or perfect the full intent and meaning of the *Contract*.
- 11.4 The provisions of the *Contract* which by their nature are continuing shall survive termination of the *Contract*.”
- 11.5 Should the *Contractor* commence performance of the *Work* prior to its execution of the *Contract*, such commencement shall be deemed to be the *Contractor's* acceptance of all terms and conditions of the *Contract* and provision of the executed *Contract* shall be required as part of the *Contractor's* first *Proper Invoice*.

DEFINITIONS

SC-7 Amend the definition of ***Consultant*** by adding the following to the end:

“Notwithstanding the foregoing, where the *Owner* has not engaged a person or entity to act as the “*Consultant*” such that no person or entity is so identified in the Agreement, the *Owner* shall be deemed to be the *Consultant* under the *Contract*.”

SC-8 Amend the definition of ***Contract Price*** by adding the following to the end:

“For certainty, the *Contract Price* is inclusive of the *Warranty Security*.”

SC-9 Delete the definition of ***Contract Time*** and replace it with the following:

Contract Time

The *Contract Time* is the time from commencement of the *Work* to the date of *Completion*, including the *Ready-for-Takeover Date* and *Completion Date*.”

SC-10 Amend the definition of ***Other Contractor*** by adding the following to the end after the word “*Project*”:

“or for other work at the *Place of the Work*”

SC-11 Amend the definition of ***Payment Legislation*** by adding the following to the end:

“For certainty, where the *Place of the Work* is in Ontario *Payment Legislation* means the *Construction Act*.”

SC-12 Add the following new definitions:

Abnormally Adverse Weather Condition

Abnormally Adverse Weather Condition means an extreme and unusual climatic condition characterized by wind speed, air temperature, precipitation, or snow fall that is less than or greater than (as applicable) one and a half (1.5) standard deviations from the mean condition determined from the official weather records of Environment and Climate Change Canada (or its successor) for the 10-year period immediately preceding the date of the abnormally adverse weather event.

Addenda

Addenda means any additions or changes to the tender documents issued by the Owner for the Work prior to the time of bid closing, if any.

Agreement Term Sheet

Agreement Term Sheet means the terms, such as dates and values that form part of the Contract as stipulated in Appendix 1 to the Supplementary Conditions – Agreement Term Sheet.

Affiliate

Affiliate means, with respect to a *Person*, or *Person* who directly or indirectly controls, is controlled by, or is under direct or indirect common control with, such *Person*, and includes any *Person* in like relation to an *Affiliate*. A *Person* shall be deemed to “control” another *Person* if such *Person* possesses, directly or indirectly, the power to direct or cause the direction of the management and policies of such other *Person*, whether through the ownership of voting securities, by contract or otherwise; and the term “controlled” shall have a similar meaning. Without limiting the foregoing, any reference to an *Affiliate* of the *Owner* shall include any *Owner Entity*.

AODA

AODA means the *Accessibility for Ontarians with Disabilities Act, 2005*, SO 2005, c. 11, as amended from time to time, or its successor legislation, and includes all regulations enacted thereunder.

AODA Regulation

AODA Regulation means Ontario Regulation 191/11 – Integrated Accessibility Standards as made under the *AODA*, as may be amended from time to time, or its successor regulation.

Applicable Law

Applicable Law means: (a) all laws, constitutions, treaties, statutes, codes, ordinances, orders, decrees, rules, regulations and by-laws which are or become in force during the performance of the *Work* and which relate to the *Project* or the *Work*, including the *Construction Act*, the *Environmental Protection Act*, the *OHSA* and the *WSIA*; (b) all judgments, orders, writs, injunctions, decisions, awards and directives of any *Governmental Authority* applicable to the *Project* or the *Work*; and (c) all policies, standards, guidelines, notices and protocols of any *Governmental Authority* applicable to the *Project* or the *Work*. For greater certainty, *Applicable Law* includes any restrictive covenants registered on title to the *Place of the Work*, the terms and conditions of any permit, authorization, certificate or approval issued by a *Governmental Authority* for the *Project* or the *Work*, and the terms and conditions of any official plan, zoning by-law, development agreement or site plan agreement related to the *Project* or the *Work*.

Arbitration Act

Arbitration Act means the *Arbitration Act, 1991*, SO 1991, c. 17, as amended from time to time, or its successor legislation, and includes all regulations enacted thereunder.

Background Reports

Background Reports means all reports, information and other documentation prepared by *Owner*, *Consultant*, and third parties referenced in the *Contract Documents* and made available to the Contractor regarding conditions at the *Place of the Work* and/or for performance of the *Work*.

Claims

Claims means any and all claims, liabilities, expenses, demands, losses, damages,

actions, costs (including legal costs), interest, fines, suits, or proceedings of every nature and kind whatsoever.

Completion

Completion means when the price of completion of the *Work*, including correction of any known defects, is not more than the lesser of (i) one (1%) percent of the *Contract Price*; and (ii) \$5,000, as certified by the *Consultant* in accordance with this *Contract* and the *Payment Legislation*.

Completion Date

Completion Date means the date set out for achievement of *Completion* in the *Agreement Term Sheet*, as such date may be adjusted in accordance with the *Contract*.

Confidential Information

Confidential Information means this *Contract* and all information or material of the *Owner Entities* that is of a proprietary or confidential nature, whether it is identified as proprietary or confidential or not and whether in written, documentary, graphic, oral, electronic, computer readable and/or any other form whatsoever. *Confidential Information* includes:

- .1 any information concerning or related to this *Contract* or the business or affairs of any *Owner Entities*;
- .2 the prior and future discussions between *Contractor Personnel* and *Owner Entities* regarding any business transactions between them;
- .3 information concerning intellectual property, financial information, budgets, engineering and technical reports and information, environmental reports, *Project* design information, marketing plans and sales information, know-how, cost, *Deliverables*, architectural information, contractual arrangements including, terms of agreements with *Owner Entities*, all proprietary business information or personal information; and
- .4 information in any way derived by or generated by or which comes to the knowledge of the *Contractor Personnel* from such *Confidential Information*.

The following shall not be considered to be *Confidential Information*:

- .5 information that is or becomes publicly known through no wrongful act of the *Contractor* or *Contractor Personnel*;
- .6 information that the *Contractor* obtains from a third party that has the right to disclose it;
- .7 information that the *Contractor* can establish, by documentary evidence, was already known by the *Contractor* at the time of the initial disclosure of the *Confidential Information* by the *Owner* or *Consultant*; and

- .8 information that the *Contractor* can establish, by documentary evidence, was independently developed by or on behalf of the *Contractor* without reference to the *Confidential Information*.

Consequential Damages

Consequential Damages means (i) any consequential, incidental, special, punitive, exemplary or indirect damages, and (ii) damages of any kind, however caused or characterized, for loss of actual or anticipated revenue or profits, business interruption, loss of reputation, loss of use, loss of business opportunity, increased capital or operating costs, or increased financing costs.

Construction Act

Construction Act means the *Construction Act*, RSO 1990, c. C.30, as amended from time to time, or its successor legislation, and includes all regulations enacted thereunder.

Contractor IP

Contractor IP means all designs, processes, ideas, concepts, products, recommendations, suggestions, know-how, technical expertise, methods and all *Intellectual Property Rights* owned or developed by the *Contractor Personnel*.

Construction Schedule

The *Construction Schedule* means the schedule provided by the *Contractor* and approved by the *Consultant* pursuant to subparagraph 3.4.1.1.

Contractor Personnel

Contractor Personnel means the *Contractor* and all *Subcontractors* and *Suppliers* and any other *Persons* engaged by them to perform or supply any part of the *Work* or the *Contractor's* obligations under this *Contract*, including any employees, partners, officers, directors, agents, subcontractors, subconsultants, and other *Persons* for whom they are responsible at law.

COVID-19

COVID-19 means the SARS-CoV-2 novel coronavirus that causes the disease known as COVID-19 and includes any mutation or variant of such coronavirus.

CPO-Accredited OHSMS Certification

CPO-Accredited OHSMS means a certification issued by the Chief Prevention Officer of the Ministry of Labour, Immigration, Training and Skills Development to a qualifying contractor evidencing the contractor's implementation of an occupational health and safety management system accredited by the Chief Prevention Officer of the Ministry of Labour, Immigration, Training and Skills Development in accordance with the *OHSA*.

Deliverables

Deliverables means all plans, sketches, designs, drawings, graphic representations, *Submittals*, specifications, notes, data, samples, materials, studies, reports, computer

models, scale models, mock-ups, samples, reproducible and other documents and electronic data collected, developed or produced by the *Contractor Personnel* in performance of the *Work*, including all *Intellectual Property Rights* relating thereto, if any.

Designated Works

Designated Works shall mean any *Work* for which the *Owner* requires the *Contractor* to maintain a *CPO-Accredited OHSMS Certification* as set out in the *Agreement Term Sheet* and/or Appendix 4 to the Supplementary Conditions – Designated Works.

Effective Date

Effective Date means the date of this *Contract* as identified on the first page of the *Agreement*.

Environmental Consultant

Environmental Consultant means the professional consultant retained by the *Owner* that meets the qualifications of a “qualified person” as defined under the *Soil Regulations*.

Environmental Protection Act

Environmental Protection Act means the *Environmental Protection Act*, RSO 1990, c. E.19, as may be amended from time to time, or its successor legislation, and includes all regulations enacted thereunder.

Excess Soil

Excess Soil shall have the meaning given in the *Soils Regulations*.

Force Majeure Event

Force Majeure Event means any cause or event (other than bankruptcy, insolvency or lack of funds) which prevents performance by the *Contractor* of any of its obligations under the *Contract* in whole or in part and which further meets each of the following criteria: (a) the cause or event and its effects are beyond the *Contractor*’s reasonable control; (b) the *Contractor* could not reasonably have prevented, overcome, mitigated or removed the cause or event and its effects by commercially reasonable efforts and due diligence; and (c) the cause or event and its effects do not result from (i) the *Contractor*’s bankruptcy, insolvency, lack of funds or impecuniosity, (ii) act, omission or negligence of any *Contractor Personnel*, or (iii) breach of the *Contractor*’s obligations under this *Contract*. For certainty, a *Force Majeure Event* shall in no circumstance include (i) *COVID-19*, the *Pandemic* or a *Pandemic Change in Law* (including a *Governmental Response*), (ii) climatic or weather conditions other than *Abnormally Adverse Weather Conditions*, (iii) economic, financial or market conditions, or events or (iv) death, illness, injury or other incapacitation of any individual worker, employee or independent contractor of any *Contractor Personnel*.

Governmental Authority

Governmental Authority means (a) any federal, provincial, county, municipal, local or other governmental or public department, court, minister, governor-in-council, cabinet,

commission, board, bureau, agency, commissioner, tribunal or instrumentality, (b) any subdivision or authority of any of the foregoing, and (c) any quasi-governmental or private body exercising any regulatory authority under or for the account of any of the foregoing. For certainty, *Governmental Authority* includes The Regional Municipality of Halton and the Municipality.

Governmental Response

Governmental Response means legislative amendments, controls, orders, requests and requirements imposed by *Governmental Authorities* in respect of or in response to *COVID-19* or the *Pandemic*. For certainty, *Governmental Response* includes a *Pandemic Change in Law* and the best practices recommended by the Ontario Ministry of Labour for construction site health and safety during the *Pandemic*.

Intellectual Property Rights

Intellectual Property Rights means all intellectual property rights (including rights in the nature of any copyright, trade mark, trade secret, service mark, design, drawing, patent, know-how, secret process and other similar proprietary rights, whether or not registered) and the rights to the registration of those rights and all rights or forms of protection of a similar nature or having equivalent or similar effect to any of these rights (and every renewal or extension of those rights) conferred under statute or common law or equity in any country.

MFIPPA

MFIPPA means the *Municipal Freedom of Information and Protection of Privacy Act*, R.S.O. 1990, c. M.56, as amended from time to time, or its successor legislation, and includes all regulations enacted thereunder.

Municipality

Municipality means the lower-tier municipality of the *Place of the Work*.

Net Actual Cost

Net Actual Cost means the total cost of all labour and materials identified in paragraph 6.3.7, excluding *Value Added Taxes*, but including all other eligible taxes, and is the amount prior to the application of any mark-up or additional payment rate when determining the cost of the subject work.

Notice of Award

Notice of Award means *Notice in Writing* issued by the *Owner* to the *Contractor* directing them to commence performance of the *Work*.

OHSA

OHSA means the *Occupational Health and Safety Act*, R.S.O. 1990, c. O.1, as amended from time to time, or its successor legislation, and includes all regulations enacted thereunder.

Overhead

Overhead includes: (i) costs for all items in Division 01 of the *Specifications*; (ii) all site and head office overheads of all *Contractor Personnel*; (iii) financing costs; (iv)

the salaries of superintendents, engineers, timekeepers, accountants, clerks, watch persons and all other site supervision staff above foreperson employed directly for the subject *Work*; (v) coordination with other trades affected; (vi) use of temporary offices, sheds and other general temporary site support facilities and all utilities used therein; and (vii) licences and permits other than those specific to a particular item of the *Work*. For certainty, *Overhead* includes all costs not expressly included in valuation of a change in paragraph 6.3.7.

Owner's Agent

Owner's Agent means the person or entity identified as such in the *Agreement Term Sheet*, if any.

Owner Entities

Owner Entities means the *Owner*, the *Owner's Agent* and the *Municipality*, including any employees, partners, officers, directors, agents, Members of Regional Council, and other Persons for whom they are responsible at law.

Owner Personnel

Owner Personnel means the *Owner*, the *Owner's Agent*, the *Consultant*, all *Other Contractors* and any other *Persons* engaged by them in respect of the *Work*, the *Project* or the *Owner's* obligations under this *Contract*, including any employees, partners, officers, directors, agents, subcontractors, subconsultants, and other *Persons* for whom they are responsible at law.

Pandemic

Pandemic means the *COVID-19* pandemic declared by the World Health Organization to be a pandemic on March 11, 2020, and shall include such continuing or resurgent effects of *COVID-19* upon public health as may persist notwithstanding that it may no longer constitute a declared pandemic or other public health emergency as of the *Effective Date*.

Pandemic Change in Law

Pandemic Change in Law means any change, amendment, modification, repeal or replacement in *Applicable Law* or a *Governmental Response* that: (i) came into effect after the *Effective Date*; (ii) is directly resultant from or related to the *Pandemic* or the occurrence, control or spread of *COVID-19*; and (iii) directly affects performance of the *Work*, including the *Contract Time* or the *Contract Price*. For certainty, a *Pandemic Change in Law* includes any obligation to delay commencement or suspend performance of the *Work* due to a *Governmental Response* coming into effect after the *Effective Date*.

Person

Person includes an individual, a corporation, a partnership, a trust, an unincorporated organization, a *Governmental Authority*, and the executors, administrators or other legal representatives of an individual in such capacity.

Proper Invoice

Proper Invoice means an application for payment that includes each of the elements listed in Appendix 2 to the Supplementary Conditions – Proper Invoice Requirements.

Ready-for-Takeover Date

Ready-for-Takeover Date means the date set out for achievement of *Ready-for-Takeover* in the *Agreement Term Sheet*, as such date may be adjusted in accordance with the *Contract*.

Soil Regulations

Soil Regulations means Ontario Regulation 406/19 – On-Site and Excess Soil Management as made under the *Environmental Protection Act*, as may be amended from time to time, or its successor regulation.

Submittals

Submittals are documents or items required by the *Contract Documents* to be provided by the *Contractor*, including *Shop Drawings*, samples, models, mock-ups, as-built drawings and operation and maintenance manuals.

Standard of Care

Standard of Care means the standard of care, competence, skill and diligence that would normally be provided by an experienced and prudent contractor supplying similar work and services for a project of similar size, scope, complexity, quality and prestige as the Project and in the same or similar locality as the Project.

Warranty Period

Warranty Period has the meaning given in paragraph 12.3.1.

Warranty Security

Warranty Security has the meaning given in paragraph 4.6 of Article A-4.

WSIA

WSIA means the *Workplace Safety and Insurance Act, 1997*, S.O. 1997, c. 16, Sched. A, as amended from time to time, or its successor legislation, and shall include all regulations enacted thereunder.

WSIB

WSIB means the Workplace Safety & Insurance Board of Ontario, which operates under the authority of the *WSIA*.”

GENERAL CONDITIONS

GC 1.1 CONTRACT DOCUMENTS

SC-13 Delete paragraphs 1.1.3 and 1.1.4 in their entirety and replace them with the following:

“1.1.3 The *Contractor* shall in accordance with the *Standard of Care* review the *Contract Documents* for the purpose of facilitating co-ordination and execution of the *Work* by the *Contractor*. The *Contractor* shall report promptly to the

Consultant any ambiguities, design issues or other matters requiring clarification made known to the *Contractor* or that the *Contractor* may discover from such a review.

- 1.1.4 Except for its obligation to review the *Contract Documents* and report the result pursuant to paragraph 1.1.3, the *Contractor* is not responsible for ambiguities, design issues or other matters requiring clarification in the *Contract Documents* and does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Documents*. Without limiting the foregoing, the *Contractor* shall not be liable for any damages or costs resulting from any ambiguities, design issues or other matters requiring clarification in the *Contract Documents* which the *Contractor* could not reasonably have discovered from such a review in accordance with the *Standard of Care*. If the *Contractor* does discover any ambiguities, design issues or other matters requiring clarification in the *Contract Documents*, the *Contractor* shall notify the *Owner* and *Consultant* in writing and not proceed with the work affected until the *Contractor* has received modified or additional information from the *Consultant* or *Owner* in writing. The impacts of any ambiguities, design issues or other matters requiring clarification in the *Contract Documents*, including to the *Contract Price* and *Contract Time*, shall be addressed by the parties in accordance with Part 6 – CHANGES.”

SC-14 Delete subparagraph 1.1.5.1 in its entirety and replace it with the following:

“1.1 the order of priority of documents, from highest to lowest, shall be:

- Appendix 1 to the Supplementary Conditions – *Agreement Term Sheet*
- *Addenda*
- the Agreement between *Owner* and *Contractor*, as amended by the Supplementary Conditions
- the Definitions, as amended by the Supplementary Conditions
- the General Conditions, as amended by the Supplementary Conditions
- Appendix 2 to the Supplementary Conditions – Proper Invoice Requirements
- Appendix 3 to the Supplementary Conditions – Insurance
- Division 01 of the *Specifications*
- technical *Specifications*
- material and finishing schedules
- the *Drawings*
- *Background Reports*
- Appendix 4 to the Supplementary Conditions – Designated Works”

SC-15 Add the following to the end of subparagraph 1.1.6.2 after the words “the *Work*”:

“, except to the extent the *Consultant* is indemnified as a third party beneficiary as provided in subparagraphs 9.2.7.4 and 9.5.3.4 and in paragraph 13.1.1.”

SC-16 Add new paragraph 1.1.12 as follows:

“1.1.12 The parties acknowledge and agree that this *Contract* represents the entire agreement between the parties in respect of the *Work* and the *Project* and no document shall form part of the *Contract Document* unless expressly identified in Article A-3. For certainty, no letter of intent, purchase order or work order issued by the *Owner* in respect of any of the *Contract*, the *Work* or the *Project* shall form part of the *Contract Documents* and no terms or conditions therein, if any, shall be of any force and effect.”

GC 1.4 ASSIGNMENT

SC-17 Delete paragraph 1.4.1 in its entirety and replace it with the following:

“1.4.1 The *Contractor* shall not assign, transfer or novate all or any part of the *Contract* without the written consent of the *Owner*, which consent may be withheld in the *Owner's* sole and absolute discretion. The *Owner* may assign, transfer or novate all or a portion of this *Contract* or any right, benefit or interest in all or any portion of this *Contract*, to any *Affiliate* or to any purchaser of all or part of the *Place of the Work* or *Project* in its sole discretion. The *Owner* shall otherwise not assign, transfer or novate all or any portion of the *Contract* without the written consent of the *Contractor*, which consent shall not be unreasonably withheld.”

GC 2.2 ROLE OF THE CONSULTANT

SC-18 Delete the second sentence in paragraph 2.2.3 in its entirety and replace it with the following:

“The duties, responsibilities and limitations of authority of such project representatives shall be those of the *Consultant* as described in the *Contract Documents*.”

SC-19 In the first line of paragraph 2.2.6, delete the words “Except with respect to GC 5.1 – Financing Information Required by the *Owner*,”.

SC-20 In paragraph 2.2.8:

- (1) in both the first and second sentences add the words “, written statements” after the word “interpretations”; and
- (2) add the following to the end:

“The *Owner* and the *Contractor* shall waive any claims against the *Consultant*

arising out of its making of any interpretations, written statements or findings in accordance with paragraphs 2.2.6, 2.2.7, 2.2.8, and 7.1.2, but only to the extent that any such interpretations, written statements, and findings are made by the *Consultant* in an unbiased manner and in accordance with the *Consultant's* professional standard of care at law.”

- SC-21 In paragraph 2.2.18 delete the word “immediately” and add the following to the end “Notwithstanding the foregoing, while the *Owner* will consider any reasonable objections of the *Contractor*, the *Owner* shall have absolute discretion in its appointment of a new *Consultant*.”

GC 2.3 REVIEW AND INSPECTION OF THE WORK

- SC-22 In the second sentence of paragraph 2.3.1 add the words “and the *Owner*” immediately following the words “the *Consultant*”.

GC 2.4 DEFECTIVE WORK

- SC-23 Delete paragraph 2.4.1 in its entirety and replace it with the following:

“2.4.1 The *Contractor* shall promptly correct at its expense and in a manner acceptable to the *Owner* and *Consultant* defective work that has been rejected by the *Consultant* or *Owner* as failing to conform to the *Contract Documents* whether or not specifically identified by the *Consultant* or *Owner* and whether or not the defective work was incorporated in the *Work* or the defect is the result of poor workmanship, use of defective products or damage through carelessness or other act or omission of the *Contractor*. The *Contractor* shall prioritize the correction of any defective work which, in the sole discretion of the *Owner*, adversely affects the day-to-day operations of the *Owner*, including as required by paragraph 12.3.4, and shall otherwise prioritize the correction of defective work as required so as not to interfere with, or derogate from, the *Construction Schedule*. Subject to paragraph 2.4.3 and without prejudice to any other right or remedy under this *Contract* or at law and without affecting the warranty period, if the *Contractor* fails to correct such defective work within a reasonable amount of time as determined by the *Consultant*, the *Owner* may have such defective work corrected by its own forces or *Other Contractors* at the *Contractor's* expense. Any testing (including retesting by the *Owner*) to ensure that the defective work has been corrected and complies with the *Contract Documents* shall also be carried out at the *Contractor's* expense. The *Contractor* shall not be entitled to any adjustment of the *Contract Time* for correction of defective work and the *Owner* may deduct any expenses incurred pursuant to this paragraph 2.4.1 from any amounts due and owing to the *Contractor* under this *Contract*.”

GC 2.5 OWNER'S AGENT

- SC-24 Add new GC 2.5 – OWNER'S AGENT as follows:

“GC 2.5 OWNER’S AGENT

- 2.5.1 The *Owner’s Agent* shall have the authority to exercise all rights and obligations of the *Owner* under this *Contract*.
- 2.5.2 Subject to any notified limitations in authority, the *Contractor* may rely upon any written instructions or directions provided by the *Owner’s Agent*. Neither the authority of the *Owner’s Agent* to act, nor any decision to exercise or not exercise such authority, shall give rise to any duty or responsibility of the *Owner’s Agent* to any *Contractor Personnel*.”

GC 3.1 CONTROL OF THE WORK

SC-25 Add new paragraphs 3.1.3 to 3.1.6 as follows:

- “3.1.3 Prior to commencing individual fabrication and construction activities, the *Contractor* shall verify, at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where such verification is not possible prior to fabrication or construction within the *Contract Time*, or dimensions are not included or contradictions exist, or exact locations are not apparent, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceeding with any part of the affected work.
- 3.1.4 To the extent applicable, the *Contractor* shall in consultation with the *Owner* schedule, coordinate and perform the *Work* as required to prevent or, where prevention is not possible, to minimize, any impacts to the *Owner’s* continuing business operations.
- 3.1.5 The *Contractor* and its *Subcontractors* shall attend meetings with respect to the *Work* as may be directed by the *Consultant* or *Owner*. The *Contractor* shall not claim any extra compensation for attendance at these meetings. The *Contractor* and its *Subcontractors* shall provide competent representatives to attend such meetings who are authorized to make undertakings on their behalves.
- 3.1.6 Prior to commencement of the *Work* the *Contractor* shall provide to the *Owner* certificates of insurance evidencing coverage as required by this *Contract*, a clearance certificate from the *WSIB* stating that all amounts owed to date have been paid in full.”

GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

SC-26 In paragraph 3.2.1 add the words “or for other work at the *Place of the Work*” after the words “the *Project*”.

SC-27 Delete subparagraph 3.2.2.1 in its entirety and replace it with the following:

- “1 cause such *Other Contractors* and *Owner’s* own forces to comply with the instructions of the *Contractor* relating to coordination and scheduling of the activities and work of such *Other Contractors* and the *Owner’s* own forces at the *Place of the Work* with the *Work* of the *Contract*.”

GC 3.4 CONSTRUCTION SCHEDULE

SC-28 Delete paragraph 3.4.1 in its entirety and replace it with the following:

“3.4.1 The *Contractor* shall:

- .1 prepare and submit to the *Owner* and the *Consultant* ten (10) *Working Days* after receipt of the *Notice of Award* a construction schedule that meets all requirements of the *Contract Documents* and that indicates the timing of the major activities of the *Work* and provides sufficient detail of the critical events and their interrelationship to demonstrate the *Work* will be performed in conformity with the *Contract Time*. Upon the *Consultant’s* acceptance of such schedule in writing, in consultation with the *Owner*, it shall become the *Construction Schedule*;
- .2 make the native form of the *Construction Schedule* available to the *Owner* and *Consultant* upon request;
- .3 complete the *Work* in accordance with the *Construction Schedule* and provide the expertise and resources, including manpower and *Construction Equipment*, as necessary to maintain progress under the *Construction Schedule*;
- .4 monitor the progress of the *Work* on a bi-weekly basis relative to the *Construction Schedule* and advise the *Consultant* and the *Owner* bi-weekly in writing of any variation from or slippage in performance of the *Work* in accordance with the *Construction Schedule*, together with a detailed explanation of any delays and a plan to mitigate the delay;
- .5 advise the *Consultant* of any revisions required to the *Construction Schedule* as the result of extensions of the *Contract Time* as provided in Article A-10 and Part 6 – CHANGES IN THE WORK;
- .6 update and submit to the *Consultant* and *Owner* an electronic copy of an updated *Construction Schedule* on a monthly basis and upon request by the *Consultant* or *Owner*, which submission shall include a comparison of the updated *Construction Schedule* to the accepted *Construction Schedule*, a summary of actual and forecast progress of the *Work* relative to the *Construction Schedule*, and a description of the basis of and logic for any changes made to the *Construction Schedule* in conformance to requirements of the *Contract Documents*; and

- .7 subject to Article A-10 and Part 6 – CHANGES IN THE WORK, provide overtime work without adjustment to the *Contract Price* if such work is deemed necessary to mitigate delay and/or recoup lost time in order to meet the *Construction Schedule*.”

SC-29 Add new paragraph 3.4.2 as follows:

“3.4.2 At the time of commencement of the *Work*, the *Contractor* shall prepare for the review and acceptance of the *Owner* and the *Consultant* a schedule indicating the times within the *Construction Schedule* that *Products* specified to be purchased by the *Owner* and installed or connected by the *Contractor* are required to be delivered to the *Place of the Work* to allow for performance of the *Work* within the *Contract Time* and avoid delaying the progress of the *Work*.”

GC 3.6 SUBCONTRACTORS AND SUPPLIERS

SC-30 Amend paragraph 3.6.1.2 by adding the following to the end of the paragraph:

“including a clause permitting assignment of the subcontract by the *Contractor* to the *Owner* or any designated contractor (including an *Other Contractor*) of the *Owner* upon written notice of the *Contractor* to the *Subcontractor* or *Supplier* or, in the event of any default by the *Contractor* pursuant to paragraph 7.1.1, upon written notice of the *Owner* to the *Subcontractor* or *Supplier*.”

SC-31 Add the following to paragraph 3.6.2:

“The *Contractor* agrees not to change any such *Subcontractors* without the prior written consent of the *Owner*, such consent not to be unreasonably withheld.”

SC-32 Add the following new paragraph 3.6.7 to 3.6.8:

“3.6.7 Ten (10) *Working Days* after receipt of the *Notice of Award* the *Contractor* shall submit to the *Owner* a list of all *Subcontractors* proposed to perform the *Work* and the names of all senior staff of the *Contractor* that will perform, supervise and coordinate the *Work*.

3.6.8 Notwithstanding any other term in this *Contract*, under no circumstance shall the *Contractor* employ as a *Subcontractor* or *Supplier* any *Person* identified on the *Owner’s* list of suspended subcontractors and suppliers which list is available online here: [<https://www.halton.ca/The-Region/Finance-and-Transparency/Doing-Business-with-the-Region>]. The *Contractor* shall not be entitled to adjustment of the *Contract Price* or *Contract Time* where it is required to change a proposed *Subcontractor* or *Supplier* due to their inclusion on such list. The *Contractor* shall also prohibit its *Subcontractors* and *Suppliers* from employing for the *Project* any such *Persons*.”

GC 3.7 LABOUR AND PRODUCTS

SC-33 Add the following to the end of paragraph 3.7.1:

“The *Contractor* represents that it has sufficient skilled employees to replace, subject to the *Owner*’s approval, acting reasonably, its designated supervisor and project manager in the event of death, incapacity, removal or resignation.”

SC-34 Add paragraphs 3.7.4 to 3.7.9 as follows:

“3.7.4 Ten (10) *Working Days* after receipt of the *Notice of Award* the *Contractor* shall submit to the *Owner* and *Consultant* an itemized list of *Suppliers* and manufacturers for *Products* that are to be supplied for the *Work* as specified in the *Contract Documents*. The *Contractor* shall provide the specification section reference, description of the *Product*, manufacturer, *Supplier* and any other information requested by the *Owner* or *Consultant*. Upon acceptance of such list by the *Owner* the *Contractor* agrees to use the *Products* specified in such approved itemized list.

3.7.5 All products and materials existing at the *Place of the Work* as of the *Effective Date* shall remain the property of the *Owner*. All *Products* to be incorporated in the *Work* shall become the property of the *Owner* at the earlier of: (i) incorporation of the *Product* into the *Work*; and (ii) payment in whole or in part for the *Product* by the *Owner*. Notwithstanding transfer of title and ownership to the *Owner*, the *Contractor* shall remain responsible for any loss or damage to *Products* until *Ready-for-Takeover* has been achieved.

3.7.6 All *Products* which are specified in the *Contract Documents* by their proprietary names or by part or catalogue numbers, are to form the basis for the specifications of such *Products*. No substitute for any such *Products* may be used without the *Consultant*’s written approval, acting reasonably. Substitutes for *Products* specified in the *Contract Documents* or approved by the *Owner* pursuant to paragraph 3.7.4 will be permitted only when: (i) request for the substitution is submitted in sufficient time to permit proper investigation and written approval by the *Consultant*, acting reasonably; and (ii) the specified *Product* has been discontinued, is unavailable or, due to such *Product*’s delivery being on the critical path it cannot be delivered within the time required for performance of the *Work* within the *Contract Time*. When requesting approval for the use of substitutes, the *Contractor* shall include in its submission sufficient details regarding the subject *Product*’s discontinuance, availability or impact on the critical path, as applicable, together with a description of any effect (increase or decrease) that the substitution may have on the *Contract Price* and, if applicable, written approval from all *Governmental Authorities*. No adjustment to the *Contract Time* shall result from the use of substitutes by the *Contractor*.

3.7.7 Where the *Contractor* is of the reasonable opinion that advanced payment for a *Product* is required to secure such *Product*’s timely supply and delivery to the *Place of the Work* in compliance with the *Construction Schedule* and

Contract Time, the *Contractor* may seek consent from the *Owner* to include application for payment for such *Product* in a *Proper Invoice* prior to its incorporation into the *Work* by *Notice in Writing* to the *Owner* and *Consultant*, which *Notice in Writing* shall include a description of the circumstances giving rise to the need for such advanced payment and identifying whether the stockpiling or storage of such *Products* at the *Place of the Work* will be required pursuant to paragraph 3.7.8. With any *Proper Invoice* seeking advanced payment (as approved by the *Owner* pursuant to this paragraph 3.7.7), the *Contractor* shall include a receipt with proof of payment for the *Product* or such other documentation as reasonably required by the *Owner* to confirm payment by the *Contractor* for such *Product*. The *Owner* may approve or refuse any request for advanced payment for *Products* in its sole and absolute discretion.

- 3.7.8 No *Products* shall be stockpiled or stored at the *Place of the Work* before their anticipated incorporation into the *Work* unless, in the reasonable opinion of the *Consultant* and the *Owner*, the stockpiling or storage of such *Products* at the *Place of the Work* is feasible and necessary or desirable, including because of advanced payment for such *Products* as approved by the *Owner* pursuant to paragraph 3.7.6, then the *Contractor* shall obtain the prior written approval of the *Owner* for stock piling or storage of *Products* at the *Place of the Work*. The *Contractor* acknowledges and accepts that the *Owner* may not have space for storage of *Products* at the *Place of the Work* and, as such, the *Contractor* agrees that the *Owner* shall not have any obligation to permit the stockpiling or storage of *Products* at the *Place of the Work*. Where the *Owner* does not approve storage of *Products* at the *Place of the Work*, the *Contractor* may elect at its sole cost to store such *Products* at an alternate location. The *Contractor* shall remove all surplus or rejected *Products* from the *Place of the Work*.
- 3.7.9 Where the *Owner* has made payment to the *Contractor* for *Products* prior to their delivery to the *Place of the Work*, at no additional cost to the *Owner*, the *Contractor* shall:
- .1 provide the *Owner* with an executed receipt clearly identifying the *Owner* as the owner of the subject *Products* together with any available identifying information for such *Products*, such as serial numbers;
 - .2 ensure that the *Products* are clearly marked, identified or labelled as being the property of the *Owner* during any storage or transport of such *Products*;
 - .3 ensure that when such *Products* are stored at a location other than the *Place of the Work* they are kept in a segregated location and not intermingled or co-mingled with the property of the *Contractor* or any other person;
 - .4 ensure that the *Owner* and *Consultant* have the right to access, examine

and inspect such *Products*; and

- .5 ensure that such *Products* are not subject to any landlord distress rights, security interest or other encumbrance by any person.”

GC 3.8 SHOP DRAWINGS

SC-35 Add the words “AND OTHER SUBMITTALS” to the title of GC 3.8 after the words “SHOP DRAWINGS”.

SC-36 Add the words “and other *Submittals*” after the words “*Shop Drawings*” in paragraphs 3.8.1, 3.8.2, 3.8.3, 3.8.3.2, 3.8.5, 3.8.6, and 3.8.7.

GC 3.9 CLEAN-UP

GC 3.10 DOCUMENTS AT THE SITE

GC 3.11 USE OF THE WORK

GC 3.12 CUTTING AND REMEDIAL WORK

GC 3.13 EXCESS SOILS

SC-37 Add the following new GC 3.9 CLEAN-UP, GC 3.10 DOCUMENTS AT THE SITE; GC 3.11 USE OF THE WORK, GC 3.12 CUTTING AND REMEDIAL WORK and GC 3.13 EXCESS SOILS:

“GC 3.9 CLEAN-UP

- 3.9.1 The *Contractor* shall maintain the *Work* in a safe and tidy condition and free from the accumulation of waste products and debris, other than that caused by the *Owner Personnel*, *Other Contractors* or their employees.”
- 3.9.2 Before applying for *Substantial Performance* as provided in GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK, the *Contractor* shall remove waste products and debris, other than that resulting from the work of *Owner Personnel*, *Other Contractors* or their employees and shall leave the *Place of the Work* clean and suitable for use and occupancy by the *Owner*. The *Contractor* shall remove materials, tools, *Construction Equipment*, and *Temporary Work* not required for the performance of the remaining work.
- 3.9.3 Prior to submitting its *Proper Invoice* for final payment, the *Contractor* shall remove any remaining materials, tools, *Construction Equipment*, *Temporary Work*, and waste products and debris, other than those resulting from the work of *Owner Personnel*, *Other Contractors* or their employees.
- 3.9.4 All debris and waste resulting from the *Work* shall be removed from the *Place*

of the Work expeditiously and shall be disposed of in accordance with the *Contract Documents* and *Applicable Law*. Salvage or materials from the *Work* shall not be sold at or near the *Place of the Work*.

- 3.9.5 In the event that the *Owner* or any *Governmental Authority* orders, instructs or requests that the *Owner* or *Contractor* clean-up the *Place of the Work* or any property adjacent to or in proximity to the *Place of the Work*, the *Contractor* shall be responsible for the prompt completion of such clean-up activities at its sole cost, provided that the requirement for such clean-up is related to or arises from the *Work* and except to the extent such clean-up is required due to the work of *Owner Personnel*, *Other Contractors* or their employees.
- 3.9.6 The *Owner* shall have the right to back charge the costs of cleaning required to be performed by the *Contractor* pursuant to this GC 3.9 if not done by the *Contractor* within forty eight (48) hours of receipt of written notice from the *Owner* or *Consultant*.”

GC 3.10 DOCUMENTS AT THE SITE

- 3.10.1 The *Contractor* shall keep one copy of current *Contract Documents*, submittals, reports, and records of meetings at the *Place of the Work*, in good order and available to the *Owner* and the *Consultant*.

GC 3.11 USE OF THE WORK

- 3.11.1 The *Contractor* shall confine *Construction Equipment*, *Temporary Work*, storage of *Products*, waste products and debris, and operations of *Contractor Personnel* to limits indicated by laws, ordinances, permits, or the *Contract Documents* and shall not unreasonably encumber the *Place of the Work*.

GC 3.12 CUTTING AND REMEDIAL WORK

- 3.12.1 The *Contractor* shall perform the cutting and remedial work required to make the affected parts of the *Work* come together properly.
- 3.12.2 The *Contractor* shall co-ordinate the *Work* to ensure that the cutting and remedial work is kept to a minimum.
- 3.12.3 Cutting and remedial work shall be performed by specialists familiar with the *Products* affected and shall be performed in a manner to neither damage nor endanger the *Work*.

GC 3.13 EXCESS SOILS

- 3.13 The *Contractor* expressly acknowledges that, where the *Project* involves *Excess Soil*, *Applicable Law* shall include the *Soil Regulations*. In such case, notwithstanding that the *Owner* may be a “Project Leader” as defined under the *Soil Regulations*, the *Contractor* expressly agrees and acknowledges that

the *Work* includes assumption, performance, and fulfillment of all liabilities, responsibilities and obligations of the Project Leader applicable to *Excess Soil* as set out in the *Contract Documents*. Without limiting the foregoing, in performance of the *Work* and its obligations under this *Contract* the *Contractor* shall coordinate and consult with the *Owner*, *Consultant* and *Environmental Consultant* as required to ensure compliance of the *Project* with the *Soil Regulations*.”

GC 4.1 CASH ALLOWANCES PAYMENT

SC-38 Delete paragraph 4.1.7 in its entirety and replace it with the following:

“4.1.7 At the commencement of the *Work*, the *Contractor* shall prepare for the review and acceptance of the *Owner* and the *Consultant* a schedule indicating the times within the *Construction Schedule* that items called for under cash allowances are required to be delivered to the *Place of the Work* to avoid delaying the progress of the *Work*.

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

GC 4.2 CONTINGENCY ALLOWANCE

SC-39 Add the following to the end of paragraph 4.2.4:

“For certainty, prior to *Contractor*’s submission of its *Proper Invoice* for final payment the *Contract Price* shall be reduced by the amount of any contingency allowance not authorized for expenditure under paragraph 4.2.3.”

SC-40 Add new GC 4.3 PROVISIONAL ITEMS ALLOWANCE as follows:

“GC 4.3 PROVISIONAL ITEMS ALLOWANCE

4.3.1 The *Contract Price* includes the amount of the provisional items allowance, if any, stated in the *Contract Documents*.

4.3.2 The provisional item allowance includes the *Contractor*’s overhead and profit in connection with such provisional items.

4.3.3 Expenditures under the provisional items allowance shall be authorized and valued as provided in GC 6.1 – OWNER’S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE.

4.2.4 The *Contract Price* shall be adjusted by *Change Order* to provide for any difference between the expenditures authorized under paragraph 4.3.3 and the amount of the provisional items allowance. For certainty, prior to *Contractor*’s submission of its *Proper Invoice* for final payment the *Contract Price* shall be reduced by the amount of any provisional items allowance not

authorized for expenditure under paragraph 4.3.3.”

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

SC-41 Delete GC 5.1 in its entirety and replace it with the following:

“GC 5.1 – DRAFT APPLICATIONS FOR PAYMENT

- 5.1.1 Except as stipulated in paragraph 5.1.2, on a monthly basis and no earlier than five (5) *Working Days* after the end of the applicable monthly payment period, the *Contractor* shall submit to the *Consultant* and the *Owner* a draft application for payment for the value of the *Work* performed up to the end of the subject monthly payment period. The draft application for payment shall be in the form of the *Proper Invoice Template*. The draft application for payment must contain all information and documentation required for a *Proper Invoice* as stipulated in Appendix 2 – Proper Invoice Requirements.
- 5.1.2 The *Contractor* shall not submit a draft application for payment between December 24 and January 2 inclusive or on any day that is not a *Working Day*.
- 5.1.3 The *Contractor* shall be available upon request of the *Owner* or *Consultant* to meet and review the draft application for payment prior to *Contractor’s* submission of the corresponding *Proper Invoice*.
- 5.1.4 All draft applications for payment and *Proper Invoices* shall be submitted by email to the *Owner* and *Consultant* at the email addresses stipulated in the *Agreement Term Sheet* and all such email messages shall include:
 - .1 the sender’s name, address, telephone number, fax number, if any, and e-mail address;
 - .2 the date and time of transmission; and
 - .3 the name and telephone number of a person to contact in the event of a transmission problem.
- 5.1.5 Where a draft application for payment or *Proper Invoice* is given by email between 4:00 p.m. and midnight, it shall be deemed to have been given on the following day.”

GC 5.2 APPLICATIONS FOR PAYMENT

SC-42 Delete paragraph 5.2.1 in its entirety and replace it with the following:

- “5.2.1 A minimum of five (5) *Working Days* following the *Contractor’s* submission of a draft application for payment pursuant to GC 5.1 the *Contractor* shall submit a *Proper Invoice* to the *Consultant* and the *Owner* on account as provided in Article A-5 of the Agreement which *Proper Invoice* shall be for

Work for the value of the *Work* performed up to the end of the subject monthly payment period. All *Proper Invoices* shall be submitted in accordance with paragraphs 5.1.4 and 5.1.5. Notwithstanding any other term of the *Contract*, including paragraph 5.1.2, the *Owner* shall not make payments between December 24 and January 2 inclusive or any day that is not a *Working Day* and the *Contractor* shall not submit a *Proper Invoice* on any day that is not a *Working Day*. For certainty, application for payment in respect of the *Warranty Security* shall only be made upon satisfaction of all stipulated requirements for this milestone as set out in paragraph 12.3.8.”

SC-43 Delete paragraph 5.2.2 in its entirety.

SC-44 In paragraph 5.2.3 add the words “in a *Proper Invoice*” after the words “The amount claimed” and add the following to the end:

“The amount applied for in the *Proper Invoice* for payment of the *Warranty Security* upon satisfaction of all requirements set out in paragraph 12.3.8 shall be comprised of the amount of the *Warranty Security* less any deductions to such security applied in accordance with this *Contract*.”

SC-45 Delete paragraph 5.2.4 in its entirety and replace it with the following:

“5.2.4 At least 15 calendar days before submission of its first *Proper Invoice* the *Contractor* shall submit to the *Consultant*, in a form acceptable to the *Owner* and *Consultant*, acting reasonably, a schedule of values for the parts of the *Work*, aggregating the total amount of the *Contract Price*, so as to facilitate evaluation of *Proper Invoices*.”

SC-46 Amend paragraph 5.2.6 by replacing the words “Applications for payment” with the words “*Proper Invoices*”.

SC-47 Delete paragraph 5.2.7 in its entirety.

GC 5.3 PAYMENT

SC-48 In paragraph 5.3.1 replace the words “an application for payment” with “a *Proper Invoice*”.

SC-49 Delete subparagraphs 5.3.1.1 and 5.3.1.2 in their entirety and replace them with the following:

“.1 If the *Consultant*, in consultation with the *Owner*, determines that an amount different than that applied for is properly due, the *Owner* or *Consultant* shall issue a “Notice of Non-Payment” pursuant to the *Construction Act* on behalf of the *Owner*.

.2 Subject to any “Notice of Non-Payment” issued pursuant to the *Construction Act* on behalf of the *Owner*, the *Owner* shall make payment to the *Contractor* on

account as provided in Article A-5 of the Agreement – PAYMENT no later than twenty-eight (28) calendar days from the date of receipt of such *Proper Invoice* and, in any event, in compliance with the *Payment Legislation*.”

SC-50 Add new paragraphs 5.3.2 to 5.3.5 as follows:

- “5.3.2 If the *Contractor* fails to provide any element of a *Proper Invoice*, including a statutory declaration or the workers’ compensation clearance certificate, the application for payment will not constitute a *Proper Invoice*, and if required by the *Payment Legislation*, the *Owner* shall provide the *Contractor* with written notice of the deficiency and what is required to address such deficiency within seven (7) calendar days of receipt of such deficient application for payment in accordance with the *Payment Legislation*. Subject to the *Payment Legislation*, the *Owner* shall not be required to make payment to the *Contractor* until a complete *Proper Invoice* is submitted.
- 5.3.3 Except as provided in paragraph 6.3.11, the *Contractor* shall have no entitlement to payment and no *Proper Invoice* may be submitted for changes in the *Work* without a written *Change Order* issued by the *Owner*.
- 5.3.4 The *Owner* may withhold from payment amounts as determined by the *Owner* or *Consultant*, acting reasonably, to ensure correction of defective work and may also provide for the retention of amounts in addition to the statutory holdback provided for in the *Contract* sufficient to protect the *Owner* against all liens of which the *Owner* has notice.
- 5.3.5 Following receipt by the *Contractor* of statutory declarations from *Suppliers* or *Subcontractors* of any tier, the *Contractor* shall promptly provide the *Owner* and *Consultant* with copies of such statutory declarations.”

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

SC-51 Delete all paragraphs of GC 5.4 in their entirety and replace them with the following:

- “5.4.1 When the *Contractor* considers that *Substantial Performance of the Work* has been achieved, or if permitted by the *Payment Legislation* a designated portion of the *Work* which the *Owner* agrees to accept separately is substantially performed, the *Contractor* shall, within five (5) *Working Days*, deliver to the *Consultant* and to the *Owner* a written application for a review by the *Consultant* to establish *Substantial Performance of the Work* or substantial performance of the designated portion of the *Work*, which application shall include the following:
- a. A comprehensive list of work to be completed or corrected including all deficient or defective work identified by the *Owner* and *Consultant* and the cost for completion and correction of such work,

- b. A list of work which cannot be performed for reasons beyond the control of the *Contractor* including the proposed date for completion of such work and the cost for completion of such work,
- c. A declaration to the effect that:
 - i. the *Contract* is substantially performed,
 - ii. the performance of the balance of the *Contract* is in progress, and
 - iii. where the balance of the *Contract*, or a part or parts thereof cannot be performed forthwith, but must be deferred for reasons beyond the control of the *Contractor*, the balance of the *Contract* shall be completed by a fixed date,
- d. All documentation required pursuant to GC 10.4 – WORKERS’ COMPENSATION, including a clearance certificate from the *WSIB* stating that all amounts owed to the date of *Substantial Performance of the Work* have been paid in full,
- e. A statutory declaration using the latest CCDC 9A form of “Statutory Declaration of Progress Payment Distribution by Contractor”,
- f. A list of all outstanding or potential *Claims* of the *Contractor* under the *Contract* as of the date of its application for *Substantial Performance of the Work*. For certainty, the provision of this list shall in no way relieve the *Contractor* of its notice obligations under the *Contract* for any *Claim*,
- g. A statement identifying the value of *Work* done to the proposed date of *Substantial Performance of the Work* together with all documentation reasonably required by the *Owner* and *Consultant* to determine the value of same, and
- h. A statement showing the amount of holdback monies due for release and payment when all liens that may be claimed against such holdback have expired or been satisfied, discharged or otherwise provided for under the *Payment Legislation*.

Failure to include an item on the list does not alter the responsibility of the *Contractor* to complete the *Contract*.

- 5.4.2 The *Consultant* will review the *Work* to certify or verify the validity of the application and shall promptly, and in any event, no later than 15 *Working Days* after receipt of the *Contractor*’s application:

- .1 advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or

- .2 state the date of *Substantial Performance of the Work* or a designated portion of the *Work* in a certificate and issue a copy of that certificate to each of the *Owner* and the *Contractor*.

For certainty, the *Contract Price* to be used in determining achievement of *Substantial Performance of the Work* shall be the *Contract Price* as amended by any *Change Orders* issued as of the date such determination is being made and shall not include any anticipated changes to the *Contract Price* not yet confirmed by *Change Order*, including in respect of any cash allowances or contingencies.

- 5.4.3 Within no more than 7 calendar days following receipt of the certificate from the *Consultant* pursuant to paragraph 5.4.2, the *Contractor* shall cause such certificate to be published in accordance with the requirements of the *Payment Legislation* and the *Contractor* shall issue to the *Owner* and *Consultant* an application for release of the holdback. The *Contractor's* application for release of the holdback application shall include:

- .1 a copy of the advertisement containing the certificate of *Substantial Performance of the Work* placed by the *Contractor* in the appropriate construction trade newspaper;
- .2 a declaration that no written notices of lien have been received by the *Contractor*;
- .3 all documentation required pursuant to GC 10.4 – WORKERS' COMPENSATION, including a clearance certificate from the *WSIB* stating that all amounts owed to the date of *Substantial Performance of the Work* have been paid in full; and
- .4 a statutory declaration using the latest CCDC 9A form of "Statutory Declaration of Progress Payment Distribution by Contractor".

Except to the extent required by *Payment Legislation*, such application for release of the holdback shall not constitute an application for payment that is subject to *Proper Invoice* requirements.

- 5.4.4 Payment of holdback taken pursuant to the *Payment Legislation* shall be made in accordance with the *Payment Legislation*, including the annual release of such holdback, and following expiration of the holdback period following *Substantial Performance of the Work* as stipulated in the *Payment Legislation*. Within 14 calendar days of each anniversary of the *Effective Date*, the *Owner* shall publish a notice in the form prescribed in the *Payment Legislation* and, subject to paragraph 5.4.6 and the terms of the *Payment Legislation*, the *Owner* shall release the holdback accrued during the subject contract year at least sixty (60) days, but not later than seventy-four (74) days, after the date on which the notice of annual release of holdback is published. No payment of holdback shall be made unless and until all requirements of the *Payment Legislation*

have been satisfied, including that all liens that may be claimed against the holdback have expired or been satisfied, discharged or otherwise provided for as required by the *Payment Legislation*.

- 5.4.5 There shall be no progressive release of holdback for a portion of the *Work* pursuant to any applicable *Payment Legislation*.
- 5.4.6 The *Owner* may refuse to pay some or all of the lien holdback amount provided that the *Owner* complies with any applicable requirements of the *Payment Legislation*.
- 5.4.7 The *Owner's* payment of the accrued lien holdback as required by the *Payment Legislation* shall not limit, waive or diminish the *Contractor's* obligations, responsibilities, duties or liabilities under the *Contract* nor shall it constitute the *Owner's* acceptance of the *Work*. Further, no payment of holdback shall be made unless and until any liens have been satisfied, discharged or otherwise provided for under the *Payment Legislation*. Notwithstanding any such payment, the *Contractor* shall ensure that all *Work* and *Products* are protected pending *Completion* and be responsible for the correction of defects or *Work* not performed regardless of whether or not such was apparent when such payment was made."

GC 5.5 FINAL PAYMENT

SC-52 Delete paragraphs 5.5.1 to 5.5.4 in their entirety and replace them with the following:

- "5.5.1 When the *Contractor* considers that *Completion* has been achieved, the *Contractor* shall submit a draft application for final payment within no more than five (5) *Working Days* of the claimed *Completion* date and shall submit a *Proper Invoice* to the *Owner* and *Consultant* for final payment no earlier than five (5) *Working Days* after submission of such draft application for final payment.
- 5.5.2 The *Consultant* will review the *Work* to certify or verify achievement of *Completion* and shall promptly, and in any event, no later than ten (10) calendar days after receipt of the *Contractor's Proper Invoice* for final payment:
 - .1 advise the *Contractor* in writing that *Completion* has not been achieved and give reasons why, or
 - .2 state the date of *Completion* (as determined by the *Consultant*) in a certificate and issue a copy of that certificate to each of the *Owner* and the *Contractor*.
- 5.5.3 Payment of a *Proper Invoice* for final payment shall be made by the *Owner* in accordance with paragraph 5.3.1.2. All holdback amounts for finishing work prescribed by the *Payment Legislation* shall become due and payable to the

Contractor following expiration of the holdback period stipulated in the *Payment Legislation* provided that all liens that may be claimed against such holdback have expired or been satisfied, discharged or otherwise provided for as required by the *Payment Legislation*.

- 5.5.4 For certainty, all references in the *Contract Documents* to final payment or a *Proper Invoice* for final payment shall refer to the *Proper Invoice* submitted by the *Contractor* and payment to be made by the *Owner* under the *Contract* following achievement of *Completion* or following the date of termination of the *Contract* or the *Contractor's* right to continue with the *Work* notwithstanding that payment of the *Warranty Security* (less any deductions to such security applied in accordance with this *Contract*) will not be made until satisfaction of all requirements set out in paragraph 12.3.8.”

GC 5.8 SET-OFF

SC-53 Add new GC 5.8 SET-OFF as follows:

“GC 5.8 SET-OFF

- 5.8.1 Notwithstanding any other provision in the *Contract* and subject to the provisions of the *Payment Legislation*, if the *Owner* has made an overpayment on any previous *Proper Invoice*, if the *Contractor* is in default under the *Contract* (including any failure to correct deficiencies as required by the *Contract*), if any amount is due and owing by the *Contractor* to the *Owner* under this *Contract*, or if the *Contractor* has not paid undisputed amounts due to *Contractor Personnel*, then without prejudice to any other right or remedy, the *Owner* may withhold or set-off payment from the *Contractor* of the amount reasonably necessary to protect the *Owner* from loss or damage arising from such event.”

GC 6.2 CHANGE ORDER

SC-54 Add new paragraph 6.2.1A as follows:

- “6.2.1A If the *Contractor* is of the opinion that any direction or instruction received from the *Consultant* or the *Owner*, including any *Supplemental Instruction*, constitutes a proposed change in the *Work*, it shall give the *Consultant* and *Owner Notice in Writing* of such change within 5 *Working Days*, which notice shall include a written description of the alleged change in the *Work*, including a description of the anticipated impact to the *Contract Price* and *Contract Time* and all available supporting documentation. The *Consultant* will promptly investigate such alleged change in the *Work* and make a finding. If the finding is that such direction or instruction does constitute a change for which adjustment of the *Contract Price* and *Contract Time* is justified under the *Contract*, then, if the *Owner* does not dispute such finding within the time

stipulated in Part 8 – DISPUTE RESOLUTION, the *Consultant* will issue appropriate instructions for a change in the *Work* as provided in paragraph 6.2.1. If the finding is that the direction or instruction does not constitute a change for which adjustment of the *Contract Price* or *Contract Time* is justified under the *Contract*, the *Consultant* shall provide its reasons for such finding in writing to the *Owner* and *Contractor* and the *Contractor* shall proceed with the affected *Work*, including implementation of the subject direction or instruction, and may dispute the finding of the *Consultant* under this paragraph 6.2.1A in accordance with PART 8 – DISPUTE RESOLUTION. For certainty, the *Contractor* shall not delay in its implementation of the subject direction or instruction or performance of any affected *Work* while the *Consultant* investigates the alleged change and makes a finding pursuant to this paragraph 6.2.1A.”

SC-55 Add new paragraphs 6.2.3 to 6.2.6 as follows:

- “6.2.3 The *Contractor* shall prepare and submit to the *Consultant* and the *Owner* all details and supporting documentation regarding impacts of a proposed change to the *Contract Price* and *Contract Time* within ten (10) *Working Days* after notice of the proposed change is given to the *Contractor* under paragraph 6.2.1 and otherwise within five (5) *Working Days* of such details and supporting documentation becoming known or available, as applicable.
- 6.2.4 Unless otherwise agreed by the parties, the adjustment in the *Contract Price* for any change shall be determined in accordance with paragraphs 6.3.6 and 6.3.7.
- 6.2.5 For valuation of changes to the *Work*, including in respect of any contemplated *Change Order* or request for a *Change Order* by the *Contractor*, the *Contractor* shall provide the *Owner* and *Consultant* with a detailed breakdown of all expenditures itemized in paragraph 6.3.7 anticipated to be incurred in respect of the change and such other documentation as reasonably required by the *Owner* and *Consultant* to determine the anticipated expenditures to be incurred by the *Contractor* attributable to the change. The foregoing detailed breakdown shall include a breakdown of the price quotation that includes the following to the extent applicable, with appropriate supporting documentation: (i) estimated labour costs, including hours and applicable hourly rates; (ii) estimated *Product* costs, including *Supplier* quotations, estimated quantities and unit prices; (iii) estimated *Construction Equipment* costs; (iv) enumeration of all other estimated costs included in the price quotation; (v) estimated credit amounts for labour and *Products* not required on account of the proposed change; (vi) *Subcontractor* quotations, including a detailed breakdown of all of the foregoing and (vii) estimated *Contractor*’s percentage fee for profit and *Overhead* as per paragraph 6.3.6. For certainty, for all changes the *Contractor*’s percentage fee shall be as stipulated in paragraph 6.3.6.
- 6.2.6 A *Change Order* shall be a final determination and adjustment to the *Contract*

Time, and *Contract Price* in respect of the subject change and there shall be no further adjustments to the *Contract Time* or *Contract Price* or compensation or payment of any kind whatsoever based on the aggregate number, scope or value of changes in the *Work* whether resulting from *Change Orders* or *Change Directives*.

GC 6.3 CHANGE DIRECTIVE

SC-56 Delete subparagraph 6.3.6.3 in its entirety and replace it with the following:

“.3 Subject to subparagraph 6.3.6.4, in respect of the *Contractor*’s percentage fee, the *Contractor* shall be entitled to apply mark-ups as follows to the actual costs of performing the work attributable to the change as determined in accordance with paragraph 6.3.7 (exclusive of *Value Added Taxes*), which mark-ups include the *Contractor*’s fee for profit and *Overhead* (including profit and *Overhead* of all *Contractor Personnel*):

- i. for *Contractor*’s own work: a mark-up in an amount of no more than 15% of the *Net Actual Cost* of the *Contractor*’s own work
- ii. for *Subcontractor*’s own work: a mark-up in an amount of no more than 15% of the *Net Actual Cost* of the *Subcontractor*’s own work; and
- iii. *Contractor*’s mark-up on *Subcontractor*’s own work: a mark-up in an amount of not more than 10% of the *Net Actual Cost* of the *Subcontractor*’s own work.

For certainty, no further mark-up shall be applied to any costs attributable to the change, including in respect of profit and *Overhead* for *Contractor Personnel*, and regardless of the extent to which the subject work is assigned or sublet to others. If *Work* is assigned or sublet to an associate, as defined by the *Securities Act*, RSO 1990, c. S.5, as amended, no mark-up whatsoever shall be applied.”

SC-57 Add new subparagraphs 6.3.6.4 and 6.3.6.5 as follows:

- “.4 In no event shall the maximum aggregate mark-up applied by all levels of contract for overhead and profit pursuant to subparagraph 6.3.6.3 exceed 30% of the total *Net Actual Cost* of approved change.
- .5 Where the *Owner* and *Contractor* agree in writing to a rate and pricing schedule, to the extent applicable such rate and pricing schedule will be used to determine the cost of the *Contractor*’s actual expenditures and savings under paragraph 6.3.7.”

SC-58 In subparagraph 6.3.7.6 add the following to the end:

“For certainty, in determining the cost of performing the work attributable to the change no mark-up shall be applied to the actual expenditures incurred by a *Subcontractor* attributable to the change, which expenditures shall be itemized as required pursuant to paragraph 6.3.15. All profit and *Overhead* of the *Subcontractor* is included in the *Contractor*’s percentage fee to be applied pursuant to subparagraph 6.3.6.3.”

SC-59 In paragraph 6.3.11 add the following to the beginning :

“Subject to paragraph 6.3.14,”

SC-60 Add new paragraphs 6.3.14 and 6.3.15 as follows:

“6.3.14 Where a *Change Directive* stipulates a maximum amount that may be incurred in respect of such *Change Directive*, the *Contractor* shall give the *Owner* written notice at least 2 *Working Days* prior to incurring any costs in excess of such stipulated maximum and may not include in any *Proper Invoice* any amount in excess of such stipulated maximum without the prior written approval of the *Owner* in the form of a further or amended *Change Directive*. For certainty, stipulation of a maximum amount that may be incurred in respect of a *Change Directive* does not constitute the *Owner*’s agreement to the quantum of costs that may be attributable to the *Change Directive*.

6.3.15 Without limiting the *Contractor*’s obligations under this GC 6.3, for valuation of any *Change Directive* the *Contractor* shall provide the *Owner* and *Consultant* with detailed itemized breakdowns of all actual expenditures itemized in 6.3.7 and incurred in respect of the change, including detailed, substantiated time sheets, purchase orders, receipts or cost vouchers from *Subcontractors* and *Suppliers* and such other documentation as reasonably required by the *Owner* and *Consultant* to determine the actual expenditures incurred by the *Contractor* attributable to the change.”

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

SC-61 Amend subparagraphs 6.4.1.1 and 6.4.1.2 by adding the following after the words “*Contract Documents*” in each subparagraph:

“and which would not have been readily apparent prior to the *Contractor*’s commencement of the performance of the *Work* from review of the *Contract Documents* and *Place of the Work* by the *Contractor* as required by the *Contract Documents*, including pursuant to paragraph 1.5 of Article A-5 and paragraph 1.1.3 of GC 1.1”

GC 6.5 DELAYS

SC-62 Add the following to the end of paragraph 6.5.2:

“Notwithstanding the foregoing, (i) where the stop work order was issued as a result of or due to a *Force Majeure Event* this paragraph 6.5.2 shall not apply and the *Contractor’s* entitlement to adjustment of the *Contract Time* or *Contract Price* shall be governed by paragraph 6.5.3, and (ii) where the stop work order was issued as a result of or due to *COVID-19*, the *Pandemic* or a *Pandemic Change in Law*, including a *Governmental Response*, and was not the result of an act or fault of any *Contractor Personnel*, directly or indirectly, this paragraph 6.5.2 shall not apply and the *Contractor’s* entitlement to adjustment of the *Contract Time* or *Contract Price* shall be governed by the provisions of Article A-10 hereof.”

SC-63 Delete paragraphs 6.5.3 to 6.5.5 in their entirety and replace them with the following:

“6.5.3 If the *Contractor* is delayed in the performance of the *Work* by a *Force Majeure Event*, including:

- .1 labour disputes, strikes, lock-outs (including lock-outs decreed or recommended for its members by a recognized contractors’ association, of which the *Contractor* is a member or to which the *Contractor* is otherwise bound),
- .2 fire, unusual delay by common carriers or unavoidable casualties, or
- .3 *Abnormally Adverse Weather Conditions*,

then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. Except to the extent such delays result from actions by *Owner Personnel*, the *Contractor* shall only be entitled to payment for costs directly incurred with the *Owner’s* written approval to protect the *Work* and secure the *Place of the Work* during the period of such delay and to mitigate the impacts of such delay to performance of the *Work* within the *Contract Time*. For certainty, in the event of delay caused by or resultant from *COVID-19*, the *Pandemic* or a *Pandemic Change in Law*, including a *Governmental Response*, this paragraph 6.5.3 shall not apply and the *Contractor’s* entitlement to adjustment of the *Contract Time* or *Contract Price* shall be governed by the provisions of Article A-10 hereof.

6.5.4 Upon the occurrence of any event that may cause delay to performance of the *Work* the *Contractor* shall promptly give the *Owner* verbal notice of such delay event. No extension shall be made for delay unless *Notice in Writing* of the cause of delay is given to the *Consultant* and *Owner* not later than 10 *Working Days* after the commencement of the delay. In the case of a continuing cause of delay only one *Notice in Writing* shall be necessary.

6.5.5 No adjustment to the *Contract Time* shall be made because of failure of the *Consultant* to furnish instructions unless the *Consultant* has failed to furnish

such instructions within the time stipulated in any schedule agreed-to by the parties for submission and return of *Shop Drawings* and *Submittals* and the *Contractor* has given at least two (2) *Working Days' Notice in Writing* to the *Consultant* and *Owner* of the date for upon which such instructions are required.

6.5.6 Any adjustment to the *Contract Time* under this *Contract* shall be determined based on the direct impacts of the subject change or delay to the critical path for performance of the *Work* as of the date of the change or delay.

6.5.7 The *Contractor* acknowledges that the *Owner* will suffer real and significant losses if the *Contractor* fails to attain *Ready-for-Takeover* by the *Ready-for-Takeover Date*.

.1 Where the *Owner* has stipulated an amount for liquidated damages in the *Agreement Term Sheet*, then if the *Contractor* fails to achieve *Ready-for-Takeover* by the *Ready-for-Takeover Date* then the *Contractor* shall be liable to the *Owner* for liquidated damages in accordance with paragraph 4.7 of Article A-4 for each day or part day of delay until *Ready-for-Takeover* is achieved as confirmed by the *Consultant* in accordance with GC 12.1. The parties agree that such liquidated damages are not a penalty and represent a reasonable, fair and genuine pre-estimate of losses to the *Owner* anticipated to result from the *Contractor's* delay in achieving *Ready-for-Takeover* by the *Ready-for-Takeover Date*.

.2 Where the *Owner* has not stipulated an amount for liquidated damages in the *Agreement Term Sheet*, then subparagraph 6.5.7.1 shall not apply and the *Contractor* shall be liable for and shall indemnify and hold harmless the *Owner* from all *Claims* resultant from or caused by failure to achieve *Ready-for-Takeover* by the *Ready-for-Takeover Date* and/or *Completion* by the *Completion Date*, including costs incurred for the *Consultant*, any *Claims* arising under any lease agreements for the *Project* (if applicable), and any *Claims* relating to financing of the *Project*.”

GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

SC-64 Delete paragraph 6.6.1 in its entirety and replace it with the following:

“6.6.1 If the *Contractor* intends to make a claim for an increase to the *Contract Price* the *Contractor* shall give *Notice in Writing* of intent to claim to the *Owner* and to the *Consultant* within five (5) *Working Days* of commencement of the event or series of events giving rise to such claim. If the *Owner* intends to make a claim against the *Contractor* for a credit to the *Contract Price*, the *Owner* shall give *Notice in Writing* of intent to claim to the *Contractor* and the *Consultant* within five (5) *Working Days* of discovering the event or series of events giving rise to such claim. Notwithstanding the foregoing, any claim for adjustment to the *Contract Price* resultant from *COVID-19*, the *Pandemic* or

a *Pandemic Change in Law*, including a *Governmental Response*, shall be governed by the provisions of Article A-10 and this GC 6.6 shall not apply.”

SC-65 Delete paragraphs 6.6.3 and 6.6.4 in their entirety and replace them with the following:

“6.6.3 The party making a claim pursuant to this GC 6.6 shall prepare and submit to the *Consultant* and other party in writing all available details and supporting documentation regarding the claim not later than ten (10) *Working Days* after commencement of the event or series of events giving rise to such claim and shall thereafter submit all such details and supporting documentation within five (5) *Working Days* of such details and supporting documentation becoming known or available, as applicable. For certainty, the supporting documentation to be submitted shall include all evidence reasonably required by the *Consultant* to make a finding and all such supporting documentation shall be prepared at the applicable party’s own cost.

6.6.4 Without limiting paragraph 6.6.3, where the event or series of events giving rise to the claim has a continuing effect, the detailed account submitted under paragraph 6.6.3 shall be considered to be an interim account and the party making the claim shall, weekly or bi-weekly as the *Consultant* may reasonably require, submit further written interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. The party making the claim shall submit a final account within five (5) *Working Days* of the end of the effects resulting from the event or series of events.”

SC-66 Add new paragraph 6.6.7 as follows:

“6.6.7 Where the party making a claim fails to provide notice or details and supporting documentation within the time stipulated in this GC 6.6 and such failure prevents the *Consultant* or other party from mitigating or minimizing *Claims* resultant from the event or series of events giving rise to such claim or otherwise causes the other party loss or damage, then the party making the claim shall be barred from bringing the subject claim.”

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

SC-67 Delete subparagraph 7.1.5.1 in its entirety and replace it with the following:

“.1 take possession of the *Work* and *Products* at the *Place of the Work*; subject to the rights of third parties, utilize the *Construction Equipment* and *Temporary Work* at the *Place of the Work*; at the election of the *Owner*, require the *Contractor* to transfer, novate or assign all agreements with *Subcontractors* and *Suppliers* in respect of the *Work* to the *Owner* or any designated contractor (including an *Other Contractor*) of the *Owner*; finish the *Work* by whatever method the *Owner* may consider expedient, but without undue delay or expense,”

SC-68 In subparagraph 7.1.5.4 delete the words “warranty period” and replace them with the words “*Warranty Period*”.

SC-69 Add a new subparagraph 7.1.5.5 as follows:

“5 set-off against any amount payable to the *Contractor* under the *Contract* all amounts payable by the *Contractor* to the *Owner*.”

SC-70 Add a new paragraphs 7.1.7 and 7.1.8 as follows:

“7.1.7 The *Owner* shall not be liable to the *Contractor* for any *Consequential Damages* arising from termination pursuant to this GC 7.1.

7.1.8 The *Contractor* shall submit to the *Owner* and *Consultant* a *Proper Invoice* for final payment no later than 45 calendar days after the date of termination.”

GC 7.2 CONTRACTOR’S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

SC-71 Delete paragraph 7.2.2 in its entirety.

SC-72 Delete subparagraphs 7.2.3.1 and 7.2.3.2 in their entirety.

SC-73 In subparagraph 7.2.3.4 delete the words “except for GC 5.1 FINANCIAL INFORMATION REQUIRED OF THE OWNER.”

SC-74 In paragraph 7.2.4, delete “5 *Working Days*” from the second line and replace with “fifteen (15) *Working Days*”, and add the following to the end of the paragraph:

“The *Owner* shall be deemed not to be in default of its obligations under the *Contract* if it is taking active steps to remedy the default but cannot reasonably do so within the said fifteen (15) *Working Day* period.”

SC-75 In paragraph 7.2.5, delete the words “including reasonable profit” and replace them with the words “to the date of termination” and add the words “, but shall not be entitled to compensation for any *Consequential Damages*” after the words “termination of the *Contract*”.

SC-76 Add new paragraph 7.2.6 as follows:

“7.2.6 The *Contractor*’s claim for compensation under this GC 7.2 shall be submitted to the *Owner* and *Consultant* in the form of a *Proper Invoice* for final payment no later than 45 calendar days after the date of termination.”

GC 7.3 TERMINATION FOR CONVENIENCE

SC-77 Add new GC 7.3 TERMINATION FOR CONVENIENCE as follows:

“GC 7.3 TERMINATION FOR CONVENIENCE

- 7.3.1 The *Owner* may in its sole discretion terminate the *Contractor's* right to continue with the *Work* in whole or in part or this *Contract* for any reason, including without cause or for convenience, at any time by giving at least 30 calendar days' *Notice in Writing* of such termination to the *Contractor* specifying the date of termination.
- 7.3.2 In the event of termination pursuant to paragraph 7.3.1, the *Contractor* shall be entitled to be paid for all work performed to the date of termination, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a direct result of such termination, but shall not be entitled to compensation for any *Consequential Damages*. The *Contractor's* claim for such compensation shall be submitted to the *Owner* and *Consultant* in the form of a *Proper Invoice* for final payment no later than 45 calendar days after the date of termination.
- 7.3.3 If the *Owner* terminates the *Contract* for convenience pursuant to paragraph 7.3.1, the *Contractor* shall deliver to the *Owner* within ten (10) days of the termination all documents related to the *Work* and anything additional as requested by the *Owner* or *Consultant*, and thereupon the *Owner* shall pay the *Contractor* any unpaid portion of the *Contractor's* fee in accordance with paragraph 7.3.2."

GC 8.1 AUTHORITY OF THE CONSULTANT

SC-78 In paragraph 8.1.2 delete the words "paragraph 8.1.3 and paragraphs 8.3.3 to 8.3.8 of".

SC-79 In paragraph 8.1.3, add the following after the first sentence:

"The *Contractor* shall continue performance of the *Work* notwithstanding any such dispute and shall ensure all other *Contractor Personnel* also do so."

GC 8.2 ADJUDICATION

SC-80 Delete paragraph 8.2.1 in its entirety and replace it with the following:

"8.2.1 Nothing in this *Contract* shall be deemed to affect the rights of the parties to resolve any dispute by adjudication as may be provided for by applicable legislation. Further, in addition to the matters that may be referred to adjudication pursuant to the *Payment Legislation*, the parties agree that any dispute relating to costs resultant from termination of the *Contract* or of the *Contractor's* right to continue with the *Work* or payments due and owing in the event of or following any such termination may be referred by either party to adjudication. For certainty, no dispute regarding the validity of any such termination may be referred to adjudication and any such dispute shall be resolved in accordance with GC 8.3."

SC-81 Add new paragraphs 8.2.2 and 8.2.3 as follows:

- “8.2.2 To the extent permitted by the *Construction Act* and except as required for performance of the parties’ obligations under this *Contract* or exercise of their rights under the *Construction Act*, any adjudication in respect of the *Contract* and *Project*, including all documentation and materials exchanged and any resultant award or order issued by an adjudicator, shall be confidential as between the parties.
- 8.2.3 Where a Notice of Adjudication is received, the *Owner* or the *Contractor*, as the case may be, shall give notice to the other using the appropriate forms found on the ODACC website (<https://odacc.ca/en/>) and in accordance with section 13.7 of the *Construction Act*. In the case of the *Contractor*’s Notice, it shall be delivered to the *Owner* at the following e-mail address: construction@halton.ca, as well as to the *Owner*’s Project Manager and the *Consultant* by email. All subsequent documents which are required to be delivered in writing to the *Owner* in relation to the *Contractor*’s Notice of Adjudication shall be delivered to the *Owner*’s Project Manager and *Consultant* using the ODACC’s Custom System.”

GC 8.3 NEGOTIATION, MEDIATION AND ARBITRATION

SC-82 Delete paragraph 8.3.1 in its entirety.

SC-83 Delete paragraph 8.3.2 in its entirety and replace it with the following:

- “8.3.2 For any finding of the *Consultant* under GC 2.2 – ROLE OF THE CONSULTANT that is clearly identified as a finding for the purposes of this paragraph 8.3.2 of the *Contract*, a party shall be conclusively deemed to have accepted such finding and to have expressly waived and released the other party from any claims in respect of the particular matter dealt with in that finding unless, within 15 *Working Days* after receipt of that finding, the party sends a *Notice in Writing* of dispute to the other party and to the *Consultant*, which contains the particulars of the matter in dispute and the relevant provisions of the *Contract Documents*.”

SC-84 Delete paragraphs 8.3.4, 8.3.5 and 8.3.6 in their entirety and replace them with the following:

- “8.3.4 Following receipt of a responding party’s *Notice in Writing* of reply under paragraph 8.3.2, the parties may elect to engage in mediated negotiations to assist the parties in reaching agreement on any unresolved dispute.
- 8.3.5 If the dispute is not resolved at a mediation or if the parties do not agree to mediate the dispute, either party may terminate the mediation by giving *Notice in Writing* to other party and the *Consultant*.
- 8.3.6 Upon termination of the mediation pursuant to paragraph 8.3.5 the dispute shall be finally resolved by arbitration which may be commenced by the *Owner* by *Notice in Writing* to the *Contractor* or by the *Contractor* with the

written consent of the *Owner* by *Notice in Writing* to the *Owner*. The arbitration shall be conducted in the jurisdiction of the *Place of the Work* and the parties agree that the arbitral award shall be final and binding and may only be appealed to the court on a question of law subject to the leave of such court as may be granted in accordance with subsection 45(1) of the *Arbitration Act*. For certainty, there shall be no appeal of the arbitral award on a question of fact or mixed fact and law.”

SC-85 Delete paragraph 8.3.7 in its entirety.

SC-86 In paragraph 8.3.8 delete the words “*Notice in Writing* requesting arbitration in paragraph 8.3.6” and replace them with the words “termination of the mediation pursuant to paragraph 8.3.5”.

SC-87 Add the following new paragraphs 8.3.9 to 8.3.13:

“8.3.9 Within five *Working Days* of the termination of the mediation pursuant to paragraph 8.3.5, the *Owner* and the *Contractor* shall give the *Consultant* a written notice containing:

- .1 a copy of supplementary conditions 8.3.9 to 8.3.14 of this *Contract*, and;
- .2 a description of any claims or issues which the *Contractor* or the *Owner*, as the case may be, wishes to raise in relation to the *Consultant* arising out of the issues in dispute in the arbitration.

8.3.10 The *Owner* and the *Contractor* agree that the *Consultant* may elect to become a full party to the arbitration under paragraph 8.3.6 if the *Consultant*:

- .1 has a vested or contingent financial interest in the outcome of the arbitration;
- .2 gives the notice of election to the *Owner* and the *Contractor* within ten (10) *Working Days* of receipt of the notice under paragraph 8.3.9;
- .3 agrees to be a party to the arbitration within the meaning of the rules referred to in paragraph 8.3.6, and,
- .4 agrees to be bound by the arbitral award made in the arbitration.

8.3.11 Without limiting and subject to the *Owner* and *Contractor*’s rights under paragraph 8.3.12 to challenge whether the *Consultant* has satisfied the requirements of paragraph 8.3.10, if an election is made under paragraph 8.3.10:

- .1 the *Owner* or *Contractor* may request particulars and evidence of the *Consultant*’s vested or contingent financial interest in the outcome of the arbitration;

- .2 the *Consultant* shall participate in the appointment of the arbitrator; and,
- .3 notwithstanding the rules referred to in paragraph 8.3.6, the time period for reaching agreement on the appointment of the arbitrator shall begin to run from the date the respondent receives a copy of the notice of arbitration.

8.3.12 The arbitrator in the arbitration in which the *Consultant* has elected under paragraph 8.3.10 to become a full party may:

- .1 on application of the *Owner* or the *Contractor*, determine whether the *Consultant* has satisfied the requirements of paragraph 8.3.10, and;
- .2 make any procedural order considered necessary to facilitate the addition of the *Consultant* as a party to the arbitration.

8.3.13 The provisions of paragraph 8.3.9 shall apply (with all appropriate changes being made) to written notice to be given by the *Consultant* to any sub-consultant.”

GC 9.1 PROTECTION OF WORK AND PROPERTY

SC-88 Amend subparagraph 9.1.1.1 by adding the following to the end:

“which the *Contractor* could not have discovered from review as required by the *Contract Documents*, including paragraph 1.1.3 of GC 1.1”

SC-89 Delete paragraph 9.1.1.2 in its entirety and replace it with the following:

“.2 negligent acts or omissions of any *Owner Personnel*.”

SC-90 Delete paragraph 9.1.2 in its entirety and replace it with the following:

“9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground utilities and structures indicated in the *Contract Documents*, or that are reasonably discoverable from inspection of the *Place of the Work* as required by the *Contract Documents*, including paragraph 1.5 of Article A-1.”

SC-91 Add new paragraphs 9.1.5 and 9.1.6 as follows:

“9.1.5 The *Contractor* shall cooperate in all respects, at no cost to the *Owner*, to provide accommodation and safe access to the *Place of the Work* or portions thereof as the *Owner Personnel* may require from time to time and as may be required by utility providers with equipment or operations located at the *Place of the Work*.

9.1.6 No *Owner Personnel* or *Owner Entities* shall have any liability for the

safeguarding or protection of, or for the loss, theft, damage, destruction, or disappearance of, any *Construction Equipment, Products, Temporary Work* or other tangible property or materials located at the *Place of the Work*, except to the extent caused by their own negligence.”

GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

SC-92 In paragraph 9.2.3 delete the first word “The” and replace it with the following:

“Without limiting any of the *Contractor*’s obligations under this *Contract*, including for overall health and safety at the *Place of the Work*, the”

SC-93 Add the following words to paragraph 9.2.6 after the word “responsible”:

“or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with *Applicable Laws*) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment or material damage to the property of the *Owner* or others,”

SC-94 Add the words “and the *Consultant*” after the word “*Contractor*” in subparagraph 9.2.7.4.

SC-95 Add the following words to paragraph 9.2.8 after the word “responsible”:

“or that any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with *Applicable Laws*) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment or material damage to the property of the *Owner* or others,”

GC 9.4 CONSTRUCTION SAFETY

SC-96 Delete paragraph 9.4.1 in its entirety and replace it with the following:

“9.4.1 The *Contractor* shall be solely responsible for: (i) construction health and safety at the *Place of the Work*, including all responsibilities of the “constructor” under the *OHS*A; (ii) compliance with the rules, regulations, and practices required by *Applicable Laws*, including the *OHS*A; and (iii) initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*. The *Contractor* shall file the requisite “notice of project” and list itself as the “constructor” with respect to the *Project*.”

SC-97 Delete paragraph 9.4.4 in its entirety and replace it with the following:

“9.4.4 The *Owner* shall cause the *Owner Personnel* to comply with all health and safety precautions and programs established by the *Contractor* at the *Place of the Work*, including by requiring such compliance in any contracts with *Owner Personnel*.”

SC-98 Add the following new paragraphs 9.4.6 to 9.4.11:

“9.4.6 The *Contractor* shall ensure appropriate health and safety instruction and training are provided to all *Contractor Personnel* (to the extent same have access to the *Place of the Work*) before the *Work* is commenced.

9.4.7 The *Contractor* and each *Subcontractor* having an accident or incident at the *Place of the Work*, as prescribed under the *OHSA*, shall promptly notify the *Owner* and the *Consultant*.

9.4.8 Prior to commencement of the *Work*, and again at any time upon request by the *Owner*, the *Contractor* shall provide the *Owner* with information and evidence regarding compliance with its obligations relating to health and safety under this *Contract* (including compliance with paragraph 3.1.6, GC 9.4 and paragraph 10.2.4), which evidence shall include: (i) a copy of the *Contractor*’s “notice of project” identifying the *Contractor* as the “constructor” with respect to the *Project* under the *OHSA*; (ii) a copy of all “Form 1000s” obtained by the *Contractor* from *Contractor Personnel* as required by the *OHSA*; (iii) a copy of all health and safety plans and programs prepared by the *Contractor* in respect of the *Place of the Work* and/or performance of the *Work*; (iv) a list with the names of *Contractor Personnel* engaged by *Contractor* for the *Work*; (v) copies of training logs and meeting minutes relating to health and safety at the *Place of the Work* and/or in performance of the *Work*; (vi) copies of any and all documentation filed by or submitted to any *Governmental Authority* by any *Contractor Personnel* in respect of the *Project*, the *Work* or the *Place of the Work*, including any accident or incident reports; (vii) evidence of completion of the *Owner*’s “Construction Health & Safety for Consultants and Constructors” training module, where required by the *Owner*; and (viii) any other documentation relating to the *Contractor*’s health and safety obligations under this *Contract* as may be reasonably requested by the *Owner*.

9.4.9 Where either (i) the *Work* constitutes *Designated Works* and/or (ii) the *Owner* requires *CPO-Accredited OHSMS Certification* as set out in the *Agreement Term Sheet*, the *Contractor* shall possess and maintain a valid *CPO-Accredited OHSMS Certification* until expiry of the *Warranty Period* and, in addition to all documentation required by paragraph 9.4.8, the *Contractor* shall provide evidence of its *CPO-Accredited OHSMS Certification* prior to commencement of the *Work* and, if applicable, immediately upon any expiry of the previous certification.

9.4.10 The *Contractor* shall complete the *Owner*’s ‘Construction Health & Safety for

Consultants and Constructors' training module, available at <https://elearning1.innovatia.net/topclass/media/Halton/CHSCC/story.html>, prior to commencement of any *Work* under this *Contract* and immediately upon any expiry of the previous certification during which the *Work* is ongoing, including until completion of the *Warranty Period*.

The *Contractor* represents that it has the experience, knowledge and expertise in respect of construction health and safety necessary for performance of the *Work* and all obligations under this *Contract* in accordance with all *Applicable Laws*, including as necessary to undertake all obligations of the “constructor” under the *OHS*A and to provide for compliance with all requirements of the *OHS*A applicable to the *Place of the Work* and performance of the *Work*. The *Contractor* further acknowledges that the *Owner Entities* do not have such knowledge, experience and expertise and are accordingly relying upon the *Contractor* in this respect.

9.4.11 The *Contractor* shall indemnify and save harmless all *Owner Personnel* and *Owner Entities* from and against any and all *Claims* arising out of any safety infractions committed by any *Contractor Personnel* or resulting from any failure by the *Contractor* to fulfill its obligations under paragraph 3.1.6, paragraph 10.2.4 and/or this PART 9 – PROTECTION OF PERSONS AND PROPERTY.

9.4.12 The provisions of this GC 9.4 shall survive the completion of the *Work* or the termination of the *Contract* for any reason whatsoever.”

GC 9.5 MOULD

SC-99 Add the words “and the *Consultant*” after the word “*Contractor*” in subparagraph 9.5.3.4.

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

SC-100 Replace all reference to “laws” and “applicable laws” in GC 10.2 with “*Applicable Laws*”.

SC-101 Delete paragraph 10.2.5 in its entirety and replace it with the following:

“10.2.5 Subject to compliance with its obligations under paragraph 1.5 of Article A-5 and paragraph 1.1.3 of GC 1.1, the *Contractor* shall not be responsible for verifying that the *Contract Documents* are in compliance with *Applicable Laws*. If the *Contract Documents* are at variance therewith, or if, subsequent to the *Effective Date*, changes are made to *Applicable Laws* which require modification to the *Contract Documents*, the *Contractor* shall advise the *Consultant* in writing requesting direction immediately upon such variance or change becoming known. The *Consultant* will issue the changes required to the *Contract Documents* as provided in GC 6.1 – OWNER’S RIGHT TO MAKE CHANGES, GC 6.2 – CHANGE ORDER and GC 6.3 – CHANGE

DIRECTIVE.”

SC-102 Delete paragraph 10.2.7 in its entirety and replace it with the following:

“10.2.7 If, subsequent to the *Effective Date*, changes are made to *Applicable Laws* which affect the cost of the *Work*, either party may submit a claim in accordance with the requirements of GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE. Notwithstanding the foregoing, any claim for adjustment to the *Contract Price* resultant from *COVID-19*, the *Pandemic* or a *Pandemic Change in Law*, including a *Governmental Response*, shall be governed by the provisions of Article A-10 and this paragraph 10.2.7 and GC 6.6 shall not apply.”

GC 10.4 WORKERS’ COMPENSATION

SC-103 In paragraph 10.4.1, replace the word “applications for payment” with the words “*Proper Invoices*”.

SC-104 Add new paragraphs 10.4.2 and 10.4.3 as follows:

“10.4.2 At any time during the term of the *Contract*, when requested by the *Owner*, the *Contractor* shall provide such evidence of compliance by the *Contractor* and *Subcontractors*.

10.4.3 The *Contractor* shall indemnify and hold harmless the *Owner* and its directors, officers and employees from and against all *Claims* by any *Contractor Personnel* with respect to workers’ compensation insurance claims. This indemnity shall survive the completion of the *Work* or the termination of the *Contract* for any reason whatsoever.”

GC 11.1 INSURANCE

SC-105 Revise paragraph 11.1.1 as follows:

(1) **Where the original *Contract Price* stipulated in the Agreement is equal to or less than \$5,000,000:** Delete paragraph 11.1.1 and replace it with the following:

“11.1.1 Without restricting the generality of GC 13.1 – INDEMNIFICATION, the *Contractor* shall provide, maintain and pay for the following insurance coverages, the requirements of which are specified in Appendix 3 to the Supplementary Conditions – Insurance in effect at the time of bid closing except as hereinafter provided:

.1 Commercial General liability insurance in the name of the *Contractor* and include, or in the case of a single, blanket policy, be endorsed to name, the *Owner* and the *Consultant*

as additional insureds but only with respect to liability, other than legal liability arising out of their sole negligence, arising out of the operations of the *Contractor* with regard to the *Work*. Commercial General liability insurance shall be maintained from the date of commencement of the *Work* until one year from the date of *Ready-for-Takeover*. Liability coverage shall be provided for completed operations hazards from the date of *Ready-for-Takeover*, as set out in the certificate of *Ready-for-Takeover*, on an ongoing basis for a period of 6 years following *Ready-for-Takeover*.

- .2 Automobile Liability Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.
- .3 Unmanned aerial vehicle aircraft, manned aircraft or watercraft Liability Insurance when owned or non-owned manned or unmanned aircraft or watercraft are used directly or indirectly in the performance of the *Work*.
- .4 “Broad form Builders Risk” property insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. The “Broad form” property insurance shall be provided from the date of commencement of the *Work* until the earliest of:
 - (1) 10 calendar days after the date of *Ready-for-Takeover*;
 - (2) on the commencement of use or occupancy of any part or section of the *Work* unless such use or occupancy is for construction purposes, habitational, office, banking, convenience store under 465 square metres in area, or parking purposes, or for the installation, testing and commissioning of equipment forming part of the *Work*; and
 - (3) when left unattended for more than 30 consecutive calendar days or when construction activity has ceased for more than 30 consecutive calendar days.
- .5 Boiler and machinery insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. Such coverage can be included as part of the Broad Form Builders Risk policy. The coverage shall be maintained continuously from commencement of use or operation of the boiler and machinery objects insured by the policy and until 10 calendar days after the date of *Ready-for-Takeover*.

- .6 The “Broad form Builders Risk” property and boiler and machinery policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. In the event of loss or damage:
- (1) the *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to such reasonable extension of *Contract Time* relative to the extent of the loss or damage as the *Consultant* may recommend in consultation with the *Contractor*;
 - (2) the *Contractor* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount which the *Owner*’s interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds in accordance with the progress payment provisions. In addition the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor*’s interest in the restoration of the *Work*; and
 - (3) to the *Work* arising from the work of the *Owner*, the *Owner*’s own forces or *Other Contractors*, the *Owner* shall, in accordance with the *Owner*’s obligations under the provisions relating to construction by the *Owner* or *Other Contractors*, pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as in accordance with the progress payment provisions.
- .7 Contractors’ Equipment Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.
- .8 Contractors’ Pollution Liability Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.”

- (2) **Where the original *Contract Price* stipulated in the Agreement is greater**

than \$5,000,000 and equal to or less than \$25,000,000: Delete paragraph 11.1.1 and replace it with the following:

“11.1.1 Without restricting the generality of GC 13.1 – INDEMNIFICATION, the *Contractor* shall provide, maintain and pay for the following insurance coverages, the requirements of which are specified in Appendix 3 to the Supplementary Conditions – Insurance in effect at the time of bid closing except as hereinafter provided:

- .1 Wrap-up liability insurance in the name of the *Contractor* and including all *Owners*, *Contractors*, *Subcontractors* and the *Consultants engaged in the work* as insureds. Wrap-up liability insurance shall be maintained from the date of commencement of the *Work* until one year from the date of *Ready-for-Takeover*. Liability coverage shall be provided for completed operations hazards from the date of *Ready-for-Takeover*, as set out in the certificate of *Ready-for-Takeover*, on an ongoing basis for a period of 6 years following *Ready-for-Takeover*.
- .2 Automobile Liability Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.
- .3 Unmanned aerial vehicle aircraft, manned aircraft or watercraft Liability Insurance when owned or non-owned manned or unmanned aircraft or watercraft are used directly or indirectly in the performance of the *Work*.
- .4 “Broad form Builders Risk” property insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. The “Broad form” property insurance shall be provided from the date of commencement of the *Work* until the earliest of:
 - (1) 10 calendar days after the date of *Ready-for-Takeover*;
 - (2) on the commencement of use or occupancy of any part or section of the *Work* unless such use or occupancy is for construction purposes, habitational, office, banking, convenience store under 465 square metres in area, or parking purposes, or for the installation, testing and commissioning of equipment forming part of the *Work*; and
 - (3) when left unattended for more than 30 consecutive

calendar days or when construction activity has ceased for more than 30 consecutive calendar days.

- .5 Boiler and machinery insurance in the joint names of the *Contractor*, the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors*. Such coverage can be included as part of the Broad Form Builders Risk policy. The coverage shall be maintained continuously from commencement of use or operation of the boiler and machinery objects insured by the policy and until 10 calendar days after the date of *Ready-for-Takeover*.
- .6 The “Broad form Builders Risk” property and boiler and machinery policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. In the event of loss or damage:
 - (1) the *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to such reasonable extension of *Contract Time* relative to the extent of the loss or damage as the *Consultant* may recommend in consultation with the *Contractor*;
 - (2) the *Contractor* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount which the *Owner*’s interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds in accordance with the progress payment provisions. In addition the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor*’s interest in the restoration of the *Work*; and
 - (3) to the *Work* arising from the work of the *Owner*, the *Owner*’s own forces or *Other Contractors*, the *Owner* shall, in accordance with the *Owner*’s obligations under the provisions relating to construction by the *Owner* or *Other Contractors*, pay the *Contractor* the cost of restoring the *Work* as the

restoration of the *Work* proceeds and as in accordance with the progress payment provisions.

- .7 Contractors' Equipment Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.
- .8 Project Specific Contractors' Pollution Liability Insurance from the date of commencement of the *Work* until one year after the date of *Ready-for-Takeover*.
- .9 Commercial General liability insurance in the name of the *Contractor* and include, or in the case of a single, blanket policy, be endorsed to name, the *Owner* and the *Consultant* as additional insureds but only with respect to liability, other than legal liability arising out of their sole negligence, arising out of the operations of the *Contractor* with regard to the *Work*. Commercial General liability insurance shall be maintained from the date of commencement of the *Work* until one year from the date of *Ready-for-Takeover*. Liability coverage shall be provided for completed operations hazards from the date of *Ready-for-Takeover*, as set out in the certificate of *Ready-for-Takeover*, on an ongoing basis for a period of 6 years following *Ready-for-Takeover*."

- (3) **Where the original *Contract Price* stipulated in the Agreement is greater than \$25,000,000:** Delete paragraph 11.1.1 and replace it with the following:

"11.1.1 The *Contractor* shall provide, maintain and pay for insurance coverages as stipulated by the *Owner* in writing prior to commencement of the *Work*. Where no written direction in respect of insurance coverages is provided by the *Owner* prior to commencement of the *Work* then the insurance requirements for projects with an original *Contract Price* greater than \$5,000,000 and equal to or less than \$25,000,000 shall apply notwithstanding that the *Contact Price* is greater than \$25,000,000."

- SC-106 In all instances and for all *Contract Prices*, delete paragraphs 11.1.6, 11.1.7 and 11.1.8 in their entirety.

GC 11.2 CONTRACT SECURITY

- SC-107 Add new GC 11.2 CONTRACT SECURITY as follows:

"GC 11.2 CONTRACT SECURITY

- 11.2.1 *Contact*or shall provide security and bonding if and as stipulated in the *Contract Documents*. Without limiting the foregoing, where the *Contract*

Price as of the Effective Date is \$500,000 or more, bonds will be provided by the Contractor as required by the Construction Act, the coverage limit of which shall include Value Added Taxes as stipulated in paragraph 4.2 of Article A-4.”

GC 12.1 READY-FOR-TAKEOVER

SC-108 Amend subparagraph 12.1.1.2 by adding the following to the end:

“and, where possible, evidence of certification by all permit-issuing authorities, indicating approval of all permitted installations.”

SC-109 Amend subparagraph 12.1.1.3 by adding the words “has been completed by the Contractor” at the end.

SC-110 Amend subparagraph 12.1.1.4 by deleting the word “immediate”.

SC-111 Amend subparagraph 12.1.1.6 by adding the words “and commissioning” after the word “testing”.

SC-112 In subparagraph 12.1.1.8 delete the word “scheduled” and replace it with the word “completed” and delete the words “, acting reasonably”.

SC-113 In paragraph 12.1.4 delete the words “10 calendar days” and replace them with the words “10 *Working Days*”.

GC 12.2 EARLY OCCUPANCY BY THE OWNER

SC-114 Delete subparagraphs 12.2.3.2 and 12.2.3.3 in their entirety and replace them as follows:

“.2 The *Owner* shall, at any and all times, have the right to enter, occupy and use the *Work* in whole or in part before completion of the *Contract*. Such entry, occupation or use shall not be considered as acceptance of the *Work* nor in any way relieve or limit the responsibilities and liabilities of the *Contractor* under the *Contract* nor affect the warranty period.

.3 For certainty, and notwithstanding occupancy by the *Owner* of a part or entirety of the *Work* before *Ready-for-Takeover* has been attained:

.1 the *Contractor* shall continue to be liable for the care of such part or entirety of the *Work* except that the *Owner* shall become responsible for preventative maintenance and shall be liable for any loss or damage caused by its negligence or fault; and

.2 the warranty period shall be as set out in paragraph 12.3.1 of GC 12.3 – WARRANTY.”

SC-115 Delete paragraph 12.2.4 in its entirety and replace it with the following:

“12.2.4 Without limiting paragraph 12.2.3, the *Contractor* shall not unreasonably interfere with such use or operation of the *Work* and *Project* by the *Owner*. The *Contractor*, in completing its obligations under the *Contract*, shall, at its own cost, take all reasonable measures to minimize the effect thereof on such use or operation.”

GC 12.3 WARRANTY

SC-116 Delete paragraph 12.3.1 and replace it with the following:

“12.3.1 The warranty period under the *Contract* is:

- .1 one year from the date when *Ready-for-Takeover* has been achieved or the date of termination of the *Contract* or the *Contractor*'s right to continue with the *Work*; or
- .2 such longer warranty period established in the *Contract Documents* for extended warranties,

(the “*Warranty Period*”).”

SC-117 Amend paragraphs 12.3.3 and 12.3.6 by deleting the words “one year warranty period” wherever they appear and replace them with the words “*Warranty Period*”.

SC-118 Delete paragraph 12.3.4 in its entirety and replace with the following:

“12.3.4 Subject to paragraph 12.3.2, within 15 *Working Days* of receipt of *Notice in Writing* pursuant to paragraph 12.3.3 (or within such other reasonable time as determined by the *Consultant*) the *Contractor* shall correct, at the *Contractor*'s expense, any defects or deficiencies in the *Work* which appear prior to and during the *Warranty Period* and shall complete such correction as expeditiously as possible, except that where the deficiency prevents maintaining security at the *Place of the Work* or prevents continued operation or functionality of systems essential to the ongoing business or operations of any *Owner Entities* as determined at the sole discretion of the *Owner*, all necessary corrections and/or installations of temporary replacements shall be carried out immediately as an emergency service. Should the *Contractor* fail to provide this emergency service within 48 hours of a request being made during the normal business hours of the *Contractor*, the *Owner* shall be authorized to carry out all necessary repairs or replacements at the *Contractor*'s expense and deduct all costs of so doing from the *Warranty Security* and, if required, otherwise recover all costs of so doing as a debt due and payable by the *Contractor* upon demand. No such action by the *Owner* shall waive or release the *Contractor* of its obligations under this *Contract*, including any warranty obligations.”

SC-119 Delete paragraph 12.3.5 and replace it with the following:

“12.3.5 The *Contractor* shall correct or pay for damage resulting from corrections made under the requirements of this GC 12.3. If the *Contractor* fails to correct defects or deficiencies in the *Work* or other damage resulting from such corrections within 15 *Working Days* after receiving written notification of the defect or deficiency or damage from the *Owner* or the *Consultant*, the *Owner* may (whether itself or through others) make such corrections at the *Contractor*’s expense and deduct all costs of so doing from the *Warranty Security* and, if required, otherwise recover all costs of so doing as a debt due and payable by the *Contractor* upon demand.”

SC-120 Add new paragraphs 12.3.7 to 12.3.9 as follows:

“12.3.7 Where manufacturers offer, as a general policy, extended warranties on their *Products* or other greater benefits than those called for in the specifications, the *Contractor* shall obtain the benefit of such extended warranties for the *Owner*. The *Contractor* shall ensure that all warranties, guarantees or other obligations for *Work* or *Products* performed or supplied by any *Contractor Personnel* in connection with the *Work* are obtained and available for the direct benefit of the *Owner*. In the alternative, the *Contractor* shall assign to the *Owner* all warranties, guarantees or other obligations for *Work* or *Products* performed or supplied by any *Contractor Personnel* and such assignment shall be with the consent of the assigning party, where required by law, or by the terms of that *Person*’s contract. Such assignment shall be in addition to, and shall in no way limit, the warranty rights of the *Owner* under the *Contract Documents*.

12.3.8 To ensure performance of the *Contractor*’s obligations as set out in GC 12.3 – WARRANTY, the *Owner* shall not make payment to the *Contractor* of the *Warranty Security* until the following has occurred, as confirmed by the *Consultant* in writing:

- .1 expiry of the *Warranty Period*; and
- .2 correction by the *Contractor* of all defects and deficiencies in the *Work* which occurred or arose prior to and during the *Warranty Period*.

12.3.9 Specified warranty periods shall not be construed as limiting the provisions of GC 13.1 – INDEMNIFICATION. Payment of holdback amounts and final payment shall not relieve the *Contractor*’s responsibility for correction of any other deficiencies or incomplete items, at no additional cost to the *Owner* pursuant to this GC12.3 – WARRANTY.”

GC 13.1 INDEMNIFICATION

SC-121 Delete paragraph 13.1.1 and replace it with the following :

- “13.1.1 The *Contractor* shall indemnify and save harmless the *Owner Entities* from and against any and all *Claims* arising out of the negligence, errors, omissions, fraud or willful misconduct of the *Contractor Personnel* attributable to or connected with the *Contractor*’s performance or non-performance of its obligations pursuant to this *Contract* except to the extent that such *Claims* are attributable or caused by the negligence of the *Owner Entities* or any of them. This indemnity shall survive the expiration or earlier termination of this *Contract* and continue in full force and effect.”
- SC-122 In paragraph 13.1.2 delete the words “The obligation of either party to indemnify as set forth in paragraph 13.1.1” and replace them with the words “The liability of either party under this *Contract*”.
- SC-123 In subparagraph 13.1.2.1 delete the words “the minimum liability insurance limit for one occurrence, of the applicable insurance policy, as referred to in CCDC 41 in effect at the time of bid closing” and replace them with the words “the amount of the minimum insurance limit for one occurrence, of the applicable insurance policy, as set forth in Appendix 3 to the Supplementary Conditions for each policy of insurance required to be provided by such party”.
- SC-124 Add the following to the end of subparagraph 13.1.2.1:
- “For certainty, each party’s liability for losses suffered by the other party for which insurance is to be provided by them pursuant to GC 11.1 – INSURANCE (as modified by the Supplementary Conditions) shall not be less in the aggregate than the total amounts of the minimum insurance limits for one occurrence for each policy of insurance as stipulated in GC 11.1 – INSURANCE (as modified by the Supplementary Conditions) as is applicable to the subject *Claims*.”
- SC-125 In subparagraph 13.1.2.3 delete the words “and neither party shall have any liability to the other for indirect, consequential, punitive or exemplary damages”.
- SC-126 Add new paragraphs 13.1.7 to 13.1.11 as follows:
- “13.1.7 The *Owner Entities* shall have no liability under this *Contract* or in respect of the *Work* or the *Project* for any *Consequential Damages*.
- 13.1.8 Without limiting the foregoing, within 10 calendar days of the *Contractor* receiving notice or otherwise becoming aware of a *Claim* initiated by a third party against an *Owner Entity* and/or the *Contractor* in respect of a matter for which the *Contractor* has indemnified the *Owner Entities* under this *Contract* and where such *Claim* has been referred to a legal proceeding or other dispute resolution proceeding, the *Contractor* shall retain legal representation and confirm in writing to the *Owner* that it shall assume the *Owner Entities*’ defence in accordance with the indemnification provisions outlined in this *Contract*, including this GC 13.1 – INDEMNIFICATION. For certainty, for the purposes of this GC 13.1 – INDEMNIFICATION “third party” shall not include any *Subcontractor*, *Supplier*, *Other*

Contractor or other person or entity engaged for the *Project*.

- 13.1.9 Where the *Contractor* receives notice or otherwise becomes aware of a *Claim* initiated by a third party against an *Owner Entity* and/or the *Contractor* in respect of a matter for which the *Contractor* has indemnified the *Owner Entities* under this *Contract* and where such *Claim* has not been referred to a legal proceeding or other dispute resolution proceeding, if the *Contractor* denies liability and does not assume responsibility for payment of such *Claim* the *Contractor* will notify the *Owner* and third party claimant in writing of its decision within 20 calendar days of receiving notice or otherwise becoming aware of the *Claim*, and the *Owner* reserves the right to assign the *Claim* to an independent insurance adjuster for investigation and determination. The *Owner* and *Contractor* shall fully cooperate with the adjuster to achieve timely resolution of such *Claim*. The *Contractor* and the *Owner* shall provide the adjuster with access to any and all records or documentation in relation to the *Work* and obligations performed under the *Contract* as required for the adjuster's determination. The *Owner* and the *Contractor* acknowledge that all *Claims* will be investigated and responded to by the adjuster within 45 calendar days of receipt of the *Claim* or within such other time as may be agreed by the parties.
- 13.1.10 The *Owner* and the *Contractor* shall be bound by the final decision of the independent adjuster who shall notify the claimant in writing of the final decision with respect to the adjustment of the *Claim*. The *Owner* shall reserve the right to communicate to the third party claimant the final decision with respect to the adjustment of the *Claim*. Where liability is found on the part of the *Contractor*, the adjuster shall handle settlement negotiations and all pertaining financial and legal transactions on behalf of the *Owner* and the *Contractor*, including but not limited to securing a full and final release and issuing the settlement funds to the third party claimant.
- 13.1.11 To the extent the adjuster determines the *Contractor* to be liable for the *Claim* under this *Contract* or at law, all costs for adjuster fees, claim administration and settlement costs will be borne by the *Contractor*. To the extent the *Contractor* is found not to be liable for the *Claim* under this *Contract* or at law, the *Owner* will bear all costs for adjuster fees, claim administration and settlement costs.
- 13.1.12 For certainty, where any *Claim* has been referred to a legal proceeding or other dispute resolution proceeding paragraphs 13.1.8 will apply (and paragraphs 13.1.9 to 13.1.11 shall not apply) and the *Contractor* may advance any denial of liability in the normal course of such proceedings."

GC 14.1 CONSTRUCTION LIENS

GC 15.1 OWNERSHIP AND CONFIDENTIALITY

GC 16.1 FREEDOM OF INFORMATION**GC 17.1 AODA REQUIREMENTS**

SC-127 Add the following new GC 14.1 CONSTRUCTION LIENS, GC 15.1 OWNERSHIP AND CONFIDENTIALITY, GC 16.1 FREEDOM OF INFORMATION and GC 17.1 AODA REQUIREMENTS:

“GC 14.1 CONSTRUCTION LIENS

- 14.1.1 In the event that a lien arising from the performance of the *Work* is registered against the *Place of the Work* or *Project* or the *Owner Entities*' interest in the *Place of the Work* or *Project*, the *Contractor* shall, within seven (7) calendar days, at its sole expense, vacate or discharge the lien from title to the *Place of the Work*. If the lien is merely vacated, the *Contractor* shall, if requested, undertake the *Owner Entities*' defence of any subsequent lawsuit commenced in respect of the lien at the *Contractor's* sole expense. The *Owner Entities* shall have the right to be represented by advisory counsel and other professionals, at its own expense, and shall be kept fully informed by the *Contractor* of the proceeding at all stages thereof whether or not so represented.
- 14.1.2 If the *Contractor* fails or refuses to vacate or discharge a construction lien within the time prescribed above, the *Owner* shall, at its option, be entitled to take all steps necessary to vacate and/or discharge the lien, and all costs incurred by the *Owner Entities* in so doing (including legal fees on a solicitor and client basis and any payment which may ultimately be made out of or pursuant to security posted to vacate the lien) shall be for the account of the *Contractor*, and the *Owner* may deduct such amounts from any amounts otherwise due or owing to the *Contractor*. If the *Owner* vacates the lien, it shall be entitled to retain all amounts it would be required to retain pursuant to the *Payment Legislation* if the lien had not been vacated.
- 14.1.3 Without limiting the generality of the foregoing, the *Contractor* shall indemnify the *Owner Entities* for all costs (including legal fees on a solicitor and client basis) they may occur in connection with the claim of lien or subsequent lawsuit brought in connection with the lien, or in connection with any other claim or lawsuit brought against the *Owner Entities* by any *Contractor Personnel*.
- 14.1.4 Where a claim for lien is received, the *Contractor* must provide a copy of the claim for lien using Form 12 prescribed by O. Reg. 303/18 to the Regional Clerk by email at the following email address: construction@halton.ca. In accordance with subsection 11.1(3) of O. Reg. 304/18 under the *Construction Act*, a copy of a claim for lien that is received after 5:00 p.m. Oakville time is deemed to have been given on the following

Business Day.

- 14.1.5 This GC 14.1 – CONSTRUCTION LIENS does not apply to liens filed by *Contractor* Personnel that are claimed as a result of any default by the *Owner* to make payments to the *Contractor* in accordance with the terms of the *Contract*.

GC 15.1 OWNERSHIP AND CONFIDENTIALITY

- 15.1.1 Subject to and without limiting paragraph 3.7.5, all *Work*, including all *Products* and all portions thereof, shall be the property of the *Owner*.
- 15.1.2 The *Contractor* grants to the *Owner* an irrevocable, perpetual, worldwide, and exclusive royalty-free license to use the *Deliverables*, including all *Contractor IP* therein, for the *Project*, including: (i) for completion of the *Project* and *Work* in the event of early termination of the *Contract*; and (ii) for the future repair, use, occupancy, expansion, operation, maintenance, and/or modification to the *Project* and *Work*. The licence shall be assignable and transferable by the *Owner* to any *Affiliate* and to any purchaser of all or part of the *Place of the Work* or *Project* provided that such *Person* assumes and agrees in writing to all limitations of use set out herein. The *Owner* may use the *Deliverables* for the purposes provided in this paragraph 15.1.2 whether or not this *Contract* is terminated, provided only that the *Owner* pays the compensation due and owing to the *Contractor* pursuant to this *Contract*. The *Deliverables* may not be reproduced for use for other projects by either party without the express written permission of the other party. The *Contractor* shall ensure that all moral rights to the *Deliverables* have been waived, including by all *Contractor Personnel*. Copies of all *Deliverables* shall be handed over by the *Contractor* to the *Owner* upon the earlier of termination of this *Contract* and submission of the *Contractor's Proper Invoice* for final payment. The *Contractor* agrees to obtain such rights from all *Contractor Personnel* as required so that the *Contractor* can grant the above-noted license.
- 15.1.3 The *Contractor* shall not, without the *Owner's* prior written consent, release or disclose any *Confidential Information* to anyone except as necessary to perform the *Work* and its obligations under this *Contract*, and then, only where the *Person* receiving such information is bound by an obligation of confidentiality consistent with this *Contract*. If any *Contractor Personnel* is required to disclose Confidential Information under a valid order of a *Governmental Authority*, the *Contractor* shall: (i) provide the *Owner* with immediate written notice of any request for disclosure; (ii) cooperate with the *Owner* in its efforts to resist or minimize the *Confidential Information* required to be disclosed; and (iii) take such steps as are reasonably necessary and available to maintain the confidentiality of the information by the *Contractor*.

- 15.1.4 The *Contractor* acknowledges that disclosure or use of the *Confidential Information* in violation of this *Contract* could cause irreparable harm to the *Owner* for which monetary damages may be difficult to ascertain or be an inadequate remedy. The *Contractor* therefore agrees that the *Owner* shall have the right, in addition to its other rights and remedies, to seek injunctive relief for any violation of its confidentiality obligations under this GC 15.1 – OWNERSHIP AND CONFIDENTIALITY.
- 15.1.5 This GC 15.1 – OWNERSHIP AND CONFIDENTIALITY shall survive the completion of the *Work* or the termination of the *Contract* for any reason whatsoever.

GC 16.1 FREEDOM OF INFORMATION & DISCLOSURE

- 16.1.1 Without limiting the foregoing, the *Owner* represents to *Contractor*, and *Contractor* acknowledges, that the *Owner Entities* are bound by *MFIPPA* and that the law might compel the *Owner Entities* to disclose certain *Confidential Information*. The *Owner Entities* are not required to take steps to oppose or prevent, or assist the *Contractor* in opposing or preventing, any disclosure of information, including *Confidential Information*, which, in the opinion of the *Owner Entities'* counsel, is legally required to be disclosed. *Contractor* shall assist and comply with any notice provided under *MFIPPA* respecting an access request that the *Owner* has received, including providing records and information to the *Owner* that the *Owner* deems to be within its control for the purposes of this *Contract*. If *Contractor* is legally compelled to disclose *Confidential Information*, for example through court order, warrant, or under applicable legislation, *Contractor* shall promptly notify the *Owner* prior to disclosure of any such *Confidential Information* so that the *Owner Entities* have an opportunity, in their sole discretion, to oppose disclosure through any available processes.

GC 17.1 AODA REQUIREMENTS

- 17.1 The *Contractor* shall, at all times, comply with the *AODA* and the *AODA Regulation*, as amended from time to time, in the performance of the *Work* under this *Contract*.
- 17.2 The *Contractor* shall ensure that all of its employees, agents, subcontractors, and any other persons engaged in providing goods, services, or facilities in connection with this *Contract* have received appropriate training on:
1. the requirements of the accessibility standards referred to in the *AODA Regulation*; and
 2. the Ontario Human Rights Code as it pertains to persons with disabilities.

- 17.3 The *Contractor* shall maintain records of the training provided pursuant to paragraph 17.2, including the dates on which training is provided and the number of individuals to whom it is provided. Upon request, the *Contractor* shall provide the *Owner* with evidence of such training (including training records), and permit the *Owner Entities* to review or audit the *Contractor's* compliance with the *AODA* and *AODA Regulation*.
- 17.4 Where the *Contractor* provides information, documents, or communication materials to the *Owner* for use by the public, including materials that are required to be shared with the *Owner Entities*, including Regional Council, the *Contractor* shall ensure that such materials are provided at no additional cost to the *Owner* and in a timely manner, either from the outset or upon request, in an accessible format or with appropriate communication supports.
- 17.5 If any material is deemed unconvertible pursuant to the *AODA Regulation*, the *Contractor* shall, upon request, provide the *Owner* with an explanation as to why the material is unconvertible and a summary of the unconvertible material, as required under section 9(3) of the *AODA Regulation*.

[END OF SUPPLEMENTARY CONDITIONS. APPENDICES FOLLOW.]

**APPENDIX 1 TO THE SUPPLEMENTARY CONDITIONS
AGREEMENT TERM SHEET**

Supplementary Condition	Contract Clause	Description	Term
SC-1	Paragraph 1.3 of Article A-1	<i>Ready-for-Takeover Date</i>	October 9, 2026
SC-1	Paragraph 1.3 of Article A-1	<i>Completion Date</i>	October 16, 2026
SC-3	Paragraph 4.6 of Article A-4	Percentage of the total amount claimed in each <i>Proper Invoice</i> to be retained by <i>Owner</i> as <i>Warranty Security</i>	2.5%
SC-3	Paragraph 4.7 of Article A-4	Amount of liquidated damages per day for each day or part day of delay until <i>Ready-for-Takeover</i> is achieved	\$250.00 CAD per day
SC 12	Definitions	Further to the definition of <i>Designated Works</i> , the <i>Owner</i> determines the Work constitutes <i>Designated Works</i>	No
SC-12	Definitions	<i>Owner's Agent</i>	N/A
SC-41	Paragraph 5.1.4 of GC 5.1	Invoice to be made out to <i>Owner's Agent</i>	Yes
SC-41	Paragraph 5.1.4 of GC 5.1	Email address(es) for submission of all draft applications for payment and <i>Proper Invoices</i> to <i>Owner</i> and <i>Consultant</i>	jon.chiarot@halton.ca harris@finnprojects.com

APPENDIX 2 TO THE SUPPLEMENTARY CONDITIONS PROPER INVOICE REQUIREMENTS

Each *Proper Invoice* submitted by the *Contractor* shall be in the form set out in Exhibit A to this Appendix 2 include the following:

- The *Contractor's* name and address;
- The date of the *Proper Invoice* and the period, milestone or other contractual payment entitled to which the *Proper Invoice* relates;
- Identification of the *Contract* and any applicable *Change Order* or *Change Directive* (being the authority under which the subject work, services, products or materials were supplied);
- A description of the subject work, services, products or materials supplied (including quantity where appropriate);
- The amount payable for the subject work, services, products or materials supplied and the payment terms;
- The name, title, telephone number and mailing address of the person to whom payment is to be sent, or, if payment is to be sent to an office or department, its name, mailing address and telephone number;
- A statement based on the schedule of values submitted pursuant to paragraph 5.2.4;
- A copy of the current *Construction Schedule* and of any look-ahead schedule required by the *Contract Documents*;
- A copy of the *Contractor's* current and up-to-date certificate of insurance evidencing compliance with GC 11.1;
- A copy of the *Contractor's* current and up-to-date certificate of completion of Halton Region's Construction Health & Safety for Consultants and Constructors training module;
- Where the *Work* constitutes *Designated Works* as set out in the *Agreement Term Sheet* and/or Appendix 4 to the Supplementary Conditions – Designated Works, a copy of the *Contractor's* current *CPO-Accredited OHSMS Certification*;
- Where payment is requested for *Products* delivered to the *Place of the Work* but not yet incorporated into the *Work*, evidence as reasonably required by the *Consultant* to establish the value and delivery of such *Products*;
- Where payment for *Products* prior to their delivery to the *Place of the Work* is approved by the Owner pursuant to paragraph 3.7.7, evidence as the *Consultant* and

Owner may reasonably require to establish (i) the value of such *Products*; (ii) compliance with paragraph 3.7.8; and (iii) that such *Products* have been ordered by the *Contractor* for the *Project* and are being manufactured, transported or stored prior to their delivery to the *Place of the Work*;

- All documentation required pursuant to GC 10.4 – WORKERS’ COMPENSATION, including a clearance certificate from the *WSIB* stating that all amounts owed to date have been paid in full;
- For each *Proper Invoice* submitted after the first, a statutory declaration using the latest CCDC 9A form of “Statutory Declaration of Progress Payment Distribution by Contractor”;
- For a *Proper Invoice* submitted in respect of final payment:
 - copies of all *Deliverables*, including as-built drawings, and copies of all warranties, guarantees and operation and maintenance manuals related to the *Work*, in hard copy and electronic format as requested by the *Owner*; and
 - an executed final waiver and release in the form attached as Exhibit B to this Appendix 2.
- Any other supporting documents required by the *Contract Documents*; and
- Any other information that is necessary for the proper functioning of the *Owner’s* accounts payable system that the *Owner* reasonably requests.

[Exhibits A and B to this Appendix 2 follow]

EXHIBIT A TO APPENDIX 2 TO THE SUPPLEMENTARY CONDITIONS PROPER INVOICE TEMPLATE

INVOICE TEMPLATE																																																																	
Invoice Period, Milestone, or Contractual basis for Payment	Insert the period, milestone or other contractual payment entitlement to which the invoice relates																																																																
Draft Invoice ☐ Proper Invoice ☐ Payment due Date	Date: Insert date draft invoice sent to owner Date: Insert date proper invoice sent to owner Insert date payment due to the contractor																																																																
Owner Address Phone Project Manager	Insert owner's name Insert owner's address Insert owner's phone number Insert owner's project manager's name																																																																
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Consultant Contract Administrator	Insert consultant's name Insert consultant's contract administrator's name																																																																
Contract Value (excl. HST) (1) Contingency Allowance (2) Approved Change Orders (3) Revised Total Contract Value (4) Estimated %age of Work Performed Contingency Unallocated	Insert current contract value including contingency Insert current contingency allowance Insert value of total approved change orders (1) - (2) + (3) (Gross payment to date) / (4) (2) - (3)																																																																
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Print Name	_____																																																																
Signature	_____																																																																
Date	_____																																																																

**EXHIBIT B TO APPENDIX 2 TO THE SUPPLEMENTARY CONDITIONS
FORM OF FINAL WAIVER AND RELEASE**

TO: [OWNER NAME AND ADDRESS] (“*Owner*”)
 FROM: [CONTRACTOR NAME AND ADDRESS] (“*Contractor*”)
 DATE OF APPLICATION
 FOR FINAL PAYMENT: [●]
 RE: CCDC 2 – 2020 Stipulated Price Contract dated [●] (the “**Contract**”)

Except for *Claims* for which *Notice in Writing* has been received by the *Owner* from the *Contractor* prior to the date of the *Contractor*’s application for final payment under the *Contract* (including all such *Claims* listed herein) or *Claims* which the *Contractor* could not reasonably have knowledge of on such date (including the *Contractor*’s claim for any amounts expressly held back by the *Owner* under the *Contract*, including in respect of any unpaid *Warranty Security*), the *Contractor* acknowledges and agrees that:

1. the *Contractor* does not have and will not make any *Claim* for additional compensation under the *Contract*, including without limitation for extras, changes or delays, or any other *Claim* whatsoever against the *Owner Entities* in connection with the *Contract*, the *Project*, or the *Work*;
2. the final payment made by the *Owner* shall be received by the *Contractor* in full and final settlement of the balance due to the *Contractor* under the *Contract* and of any and all *Claims* of the *Contractor* in connection with the *Contract* (except only for the *Contractor*’s claim for any amounts expressly held back by the *Owner* under the *Contract*, including in respect of any unpaid *Warranty Security*); and
3. the *Contractor* gives receipt of full discharge and waives its rights to any and all *Claims* not submitted as of the date of its application for final payment under the *Contract*.

As of the date of this Waiver and Release the *Contractor* has given the *Owner Notice in Writing* of the following *Claims*:

1. [LIST TO BE COMPLETED BY CONTRACTOR]

For certainty, all terms not defined herein shall have the meaning given in the *Contract*.

[CONTRACTOR NAME]

I/we have authority to bind the company

I/we have authority to bind the company

APPENDIX 3 TO THE SUPPLEMENTARY CONDITIONS INSURANCE

Where the original *Contract Price* stipulated in the Agreement is equal to or less than \$5,000,000 the following shall apply:

1. Commercial General liability insurance shall be with limits of not less than \$5,000,000 per occurrence, an aggregate limit of not less than \$5,000,000 within any policy year with respect to completed operations, and a deductible not exceeding \$10,000. The insurance coverage shall not be less than the insurance provided by IBC Form 2100 (including an extension for a standard provincial and territorial form of non-owned automobile liability policy) and IBC Form 2320. To achieve the desired limit, umbrella or excess liability insurance may be used. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.
2. Automobile liability insurance in respect of vehicles that are required by law to be insured under a contract by a Motor Vehicle Liability Policy, shall have limits of not less than \$5,000,000 inclusive per occurrence for bodily injury, death and damage to property, covering all vehicles owned or leased by the *Contractor*. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor*.
3. Manned Aircraft and watercraft liability insurance with respect to owned or non-owned aircraft and watercraft (if used directly or indirectly in the performance of the *Work*), including use of additional premises, shall have limits of not less than \$10,000,000 inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof and limits of not less than \$10,000,000 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the *Owner*.
4. Unmanned aerial vehicle liability insurance with respect to owned or non-owned aircraft (if used directly or indirectly in the performance of the *Work*), shall have limits of not less than \$5,000,000 per occurrence or accident for bodily injury, death and damage to property or such amounts as required by any applicable law or regulation.
5. “Broad form Builders Risk” property insurance shall have limits of not less than the sum of 1.1 times *Contract Price* and the full value, as stated in the *Contract*, of *Products* and design services that are specified to be provided by the *Owner* for incorporation into the *Work*, with a deductible not exceeding \$10,000. The insurance coverage shall not be less than the insurance provided by IBC Forms 4042 and 4047 or their equivalent replacement. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.
6. Boiler and machinery insurance shall have limits of not less than the replacement value of the permanent or temporary boilers and pressure vessels, and other insurable objects forming part of the *Work*. The insurance coverage shall not be less than the insurance provided by a comprehensive boiler and machinery policy including hot testing and

commissioning.

7. Contractors' equipment insurance coverage written on an "all risks" basis covering *Construction* Equipment used by the *Contractor* for the performance of the *Work*, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner*. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance, the *Owner* may agree to waive the equipment insurance requirement.
8. Contractors' Pollution liability insurance shall have limits of not less than \$5,000,000 per occurrence for bodily injury, death and damage to property, with a deductible not exceeding \$25,000.

Where the original *Contract Price* stipulated in the Agreement is greater than \$5,000,000 and equal to or less than \$25,000,000 the following shall apply:

1. Commercial General liability insurance shall be with limits of not less than \$10,000,000 per occurrence, an aggregate limit of not less than \$10,000,000 within any policy year with respect to completed operations, and a deductible not exceeding \$10,000. The insurance coverage shall not be less than the insurance provided by IBC Form 2100 (including an extension for a standard provincial and territorial form of non-owned automobile liability policy) and IBC Form 2320. To achieve the desired limit, umbrella or excess liability insurance may be used. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.
2. Wrap-up liability insurance shall be with limits of not less than \$10,000,000 per occurrence, an aggregate limit of not less than \$10,000,000 within any policy year with respect to completed operations, and a deductible not exceeding \$100,000. The insurance coverage shall not be less than the insurance provided by IBC Form 2100 (including an extension for a standard provincial and territorial form of non-owned automobile liability policy) and IBC Form 2320. To achieve the desired limit, umbrella or excess liability insurance may be used. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.
3. Automobile liability insurance in respect of vehicles that are required by law to be insured under a contract by a Motor Vehicle Liability Policy, shall have limits of not less than \$10,000,000 inclusive per occurrence for bodily injury, death and damage to property, covering all vehicles owned or leased by the *Contractor*. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor*.
4. Manned Aircraft and watercraft liability insurance with respect to owned or non-owned aircraft and watercraft (if used directly or indirectly in the performance of the *Work*), including use of additional premises, shall have limits of not less than \$10,000,000 inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof and limits of not less than \$10,000,000 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the *Owner*.

5. Unmanned aerial vehicle liability insurance with respect to owned or non-owned aircraft (if used directly or indirectly in the performance of the Work), shall have limits of not less than \$5,000,000 per occurrence or accident for bodily injury, death and damage to property or such amounts as required by any applicable law or regulation.
6. “Broad form Builders Risk” property insurance shall have limits of not less than the sum of 1.1 times *Contract Price* and the full value, as stated in the *Contract*, of *Products* and design services that are specified to be provided by the *Owner* for incorporation into the *Work*, with a deductible not exceeding \$100,000. The insurance coverage shall not be less than the insurance provided by IBC Forms 4042 and 4047 or their equivalent replacement. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.
7. Boiler and machinery insurance shall have limits of not less than the replacement value of the permanent or temporary boilers and pressure vessels, and other insurable objects forming part of the *Work*. The insurance coverage shall not be less than the insurance provided by a comprehensive boiler and machinery policy including hot testing and commissioning.
8. Contractors’ equipment insurance coverage written on an “all risks” basis covering *Construction Equipment* used by the *Contractor* for the performance of the *Work*, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner*. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance, the *Owner* may agree to waive the equipment insurance requirement.
9. Project Specific Contractors’ Pollution liability insurance shall have limits of not less than \$10,000,000 per occurrence for bodily injury, death and damage to property, with a deductible not exceeding \$25,000.

[End of Appendix 3]

APPENDIX 4 TO THE SUPPLEMENTARY CONDITIONS**DESIGNATED WORKS**

For the purposes of this *Contract*, the *Work* shall constitute *Designated Works* as follows:

- Where the *Effective Date* of the *Contract* is on or between January 1, 2026 to June 30, 2026, the *Work* shall constitute *Designated Works* if the *Contract Price* is greater than \$25,000,000.00;
- Where the *Effective Date* of the *Contract* is between July 1, 2026 to June 30, 2027, the *Work* shall constitute *Designated Works* if the *Contract Price* is greater than \$10,000,000.00;
- Where the *Effective Date* of the *Contract* is on or after July 1, 2027, the *Work* shall constitute *Designated Works* if the *Contract Price* is greater than \$1,000,000.00.

Without limiting the foregoing and regardless of the *Effective Date* and *Contract Price*, the *Owner*, in its sole discretion, may determine that the *Work* constitutes *Designated Works* by indicated such designation in the *Agreement Term Sheet*.

ATTACHMENT A

TECHNICAL SPECIFICATIONS

HALTON COMMUNITY HOUSING CORPORATION ALDERSHOT VILLAGE RESIDENCE 540 PLAINS RD. EAST- BURLINGTON HEAT PUMP UPGRADES



MECHANICAL/ELECTRICAL SPECIFICATIONS

SAB Engineering Inc.

*588 Edward Ave. unit 25, Richmond Hill,
Ont. L4C 9Y6*

Phone: 905-787 8885

E-mail: sabengineering@rogers.com

Prepared for: HCHC

INDEX OF SPECIFICATIONS

01 33 23	SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
01 79 00	DEMONSTRATION AND TRAINING
02 41 00	DEMOLITION
23 05 00	COMMON WORK RESULTS FOR HVAC
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 48	VIBRATION AND SEISMIC CONTROLS FOR HVAC
23 05 53	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93	TESTING, ADJUSTING AND BALANCING FOR HVAC
23 07 00	HVAC INSULATION
23 09 00	INSTRUMENTATION AND CONTROL FOR HVAC
23 21 13	HYDRONIC PIPING
23 21 23	HYDRONIC PUMPS
23 81 40	AIR AND WATER SOURCE UNITARY HEAT PUMPS
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL
26 05 19	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 33	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
26 22 00	LOW-VOLTAGE TRANSFORMERS
26 28 23	DISCONNECT SWITCHES - FUSED AND NON-FUSED
26 29 10	MOTOR STARTERS TO 600 V

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. GENERAL	2
1.2. DEFINITIONS	2
1.3. SUBMITTAL REGISTER	3
1.4. SUBMISSION PROCEDURES – SHOP DRAWINGS	4
1.5. SUBMISSION SCHEDULING	7
1.6. AS-BUILT DOCUMENTATION	7
1.7. RECORD DOCUMENTS EDIT LOG	8
1.8. AS-BUILT DRAWINGS	8
1.9. RECORD SPECIFICATIONS	9
1.10. OPERATION AND MAINTENANCE MANUALS	9
1.11. MAINTENANCE AND OPERATIONS MANUAL FORMATTING	12
1.12. WITHHOLDING OF PAYMENT	13
PART 2 - PRODUCTS (NOT APPLICABLE)	13
PART 3 - EXECUTION (NOT APPLICABLE)	13

PART 1 - GENERAL

1.1. GENERAL

- 1.1.1. This specification defines the general requirements and procedures for submittals. A submittal is information submitted for the Consultant's review to establish compliance with the contract documents.
- 1.1.2. Detailed submittal requirements are found in the technical sections of the contract specifications. The Consultant may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the Client.
- 1.1.3. Consultant review of a submittal does not relieve the Contractor of the responsibility for compliance with the contract documents or any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

1.2. DEFINITIONS

- 1.2.1. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.
- 1.2.2. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.
- 1.2.3. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.
- 1.2.4. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.
- 1.2.5. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

- 1.2.6. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.
- 1.2.7. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.
- 1.2.8. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.
- 1.2.9. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.
- 1.2.10. Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Operation and Maintenance manuals, as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

1.3. SUBMITTAL REGISTER

- 1.3.1. The submittal register prepared by the Contractor will list items of equipment and materials for which submittals are required by the specifications. This list may not be all inclusive and additional submittals may be required by the specifications. The Contractor is not relieved from supplying submittals required by the contract documents but which have been omitted from the submittal register.
- 1.3.2. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.
- 1.3.3. The Contractor shall provide the initial submittal register in electronic format. Thereafter, the Contractor shall track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Consultant.
- 1.3.4. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Client representative.

- 1.3.5. The Contractor shall submit formal monthly updates to the submittal register in electronic format. Each monthly update shall document actual submission and approval dates for each submittal.

1.4. SUBMISSION PROCEDURES – SHOP DRAWINGS

- 1.4.1. The Contractor shall review all shop drawings before submittal to the Consultant. This review implies that the Contractor has determined or will determine measurements and has verified or will verify on the site, the construction criteria, materials, catalog numbers and similar data, and that he has reviewed and coordinated each shop drawing with the Contractual Documents and Specifications.
- 1.4.2. Submit shop drawings to the Consultant within reasonable delays and in a logical sequence in compliance with the construction schedule.
- 1.4.3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals.
- 1.4.4. Submission Preparation
 - 1.4.4.1. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.
 - 1.4.4.2. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.
 - 1.4.4.3. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned with review.
 - 1.4.4.4. Forward submittals in sufficient time to permit proper consideration and approval action by the Consultant; minimum time required for Consultant's review shall be 10 business days or longer, if the submitted equipment does not match the standard of acceptance and additional time is required for the evaluation.
 - 1.4.4.5. Schedule submission to assure adequate lead time for procurement of contract required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
 - 1.4.4.6. The Consultant's review consists in reviewing the conformity of shop drawings with the contract documents for recommendation to the Client or Owner. The Consultant is not liable for any responsibility for dimensions, details nor quantities.

- 1.4.4.7. After an item has been reviewed by the Consultant no change in brand or make will be permitted unless:
 - 1.4.4.7.1. Satisfactory written evidence is presented to, and positively reviewed by the Consultant, that manufacturer cannot make scheduled delivery of approved item or;
 - 1.4.4.7.2. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - 1.4.4.7.3. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Client.
- 1.4.5. If the Contractor installs equipment or material for which he has not submitted shop drawings for verification, the Consultant may, if the equipment or material is not installed in accordance with plans and specifications, require the equipment or material to be removed and replaced by a compliant product at no additional cost to the Client.
- 1.4.6. Shop drawings relating to products, special design systems or installations, custom equipment or similar to, all of which are not standard or catalogued products, will be considered engineering documents and as such, shall be authenticated by their author engineer. Authentication shall be in conformity with current Province of Ontario Laws and By-Laws. As an example, not limited to, shop drawings of a custom air-handling unit are covered by the present article and as such, constitute engineering documents that will require an authentication by their author engineer.
- 1.4.7. When shop drawings are resubmitted, indicate in writing all revisions other than those required by the Consultant.
- 1.4.8. Submit for review by the Consultant, within reasonable delays of the contract award, the complete set of shop drawings required. Faxed shop drawings are not accepted.
- 1.4.9. Shop drawings shall be submitted in electronic format. The following rules must be followed entirely:
 - 1.4.9.1. The identification form must be included;
 - 1.4.9.2. A shop drawing identification sheet hereby mentioned shall be included;
 - 1.4.9.3. A single file in PDF format for each shop drawing shall be submitted. In the case where more than one document constitutes the drawing, they must all be incorporated into a single file;
 - 1.4.9.4. Printing parameters of the drawings must be incorporated in the file to assure a scaled printing on a commercial printer;
 - 1.4.9.5. The file must be of an excellent graphical quality;
 - 1.4.9.6. Transmission of the shop drawings must follow the path of communication established for the project;
 - 1.4.9.7. A transmittal sheet shall be attached to submitted drawings.

- 1.4.10. Shop drawings not following these directives will be returned to the Contractor with a "Rejected" recommendation.
- 1.4.11. Each shop drawing shall be presented with an identification form. The shop drawing identification sheet shall include as a minimum the following information:
- 1.4.11.1. Client's name
 - 1.4.11.2. Project's name
 - 1.4.11.3. Consultant's name
 - 1.4.11.4. Contractor's name
 - 1.4.11.5. Name of sender
 - 1.4.11.6. Sub contractor's name
 - 1.4.11.7. Supplier's name
 - 1.4.11.8. Specialty
 - 1.4.11.9. Description
 - 1.4.11.10. Specifications section number and article number
 - 1.4.11.11. Revision number
 - 1.4.11.12. Blank space for stamp of Conformity Review.
- 1.4.12. Submit all shop drawings in English, certified for construction by the manufacturer.
- 1.4.13. Drawings for non-standard articles or materials shall be produced, especially for the project.
- 1.4.14. Shop drawings shall include:
- 1.4.14.1. Construction details, dimensions, weights and equipment or material characteristics together with supplementary information such as bulletins, illustrations and exploded views of constituting parts.
 - 1.4.14.2. Graphs, curves, capacities, efficiency and other technical data submitted by the manufacturer or requested by the Engineer concerning the operation of the equipment.
 - 1.4.14.3. Wiring diagrams, single line diagrams, principle diagrams, control diagrams, operating sequences and all interconnections with other systems when required.
 - 1.4.14.4. Flow diagrams for air, water, oil, fuel, etc. if applicable.
 - 1.4.14.5. Marketing folders or publicity brochures will not be accepted.
- 1.4.15. Shop drawings will be returned with one or two of the following mentions: "Reviewed", "Modify and resubmit", "Modify as noted", "Rejected".
- 1.4.16. Drawings stamped "Reviewed" will not be further commented. Drawings comply with contractual documents.

- 1.4.17. Drawings stamped "Rejected" shall be done over again and resubmitted for approval. Drawings do not comply with contractual documents.
- 1.4.18. Drawings stamped "Modify as noted" shall not be resubmitted. Conditionally to the corrections indicated, drawings comply with contractual documents.
- 1.4.19. Drawings stamped "Modify and resubmit" shall be resubmitted, in part or in whole, as indicated for further examination. Drawings do not comply with contractual documents.
- 1.4.20. Drawings stamped "Modify as noted" and "Modify and resubmit" shall be resubmitted in part or in whole, as indicated, for further examination. Conditionally to the corrections indicated, drawings comply with contractual documents.
- 1.4.21. The Consultant's examination of the shop drawings does not relieve the Contractor from supplying equipment conforming to current standards and bylaws and to the requirements of this specification.
- 1.4.22. Any equipment, which is manufactured without the Engineer's prior examination, may be rejected. Assume all costs inherent to such a rejection.

1.5. SUBMISSION SCHEDULING

- 1.5.1. Submittals are to be scheduled, submitted, reviewed, and returned to the Contractor prior to the acquisition of the material or equipment. All comments marked by the Consultant shall be incorporated in the item for which a submission was made. No material or equipment shall be acquisitioned if the respective submissions was reviewed and rejected by the Consultant
- 1.5.2. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential re-submittal.
- 1.5.3. No delay costs or time extensions will be allowed for time lost in late submittals or re-submittals.
- 1.5.4. All submittals are required to be reviewed prior to the start of the specified work activity.

1.6. AS-BUILT DOCUMENTATION

- 1.6.1. During progress of the Work, Contractor shall maintain a set of Record Documents and Shop Drawings at the Site. Contractor must update these documents weekly, at a minimum, with mark-ups of actual installations that vary from the Work as originally shown. Contractor shall include all Drawings issued as addenda, clarifications, or Change Orders.

1.6.2. Contractor shall maintain and have available for review in conjunction with project progress meetings, a current set of the marked-up Record Documents and Shop Drawings..

1.6.3. Contractor must protect marked-up Record Documents from deterioration and loss in a secure location.

1.7. RECORD DOCUMENTS EDIT LOG

1.7.1. During progress of the Work, Contractor shall update the Record Documents Edit Log each time updates or edits are made, or information is added. The Record Documents Edit Log shall be submitted to the Consultant and Client prior to submitting each monthly Application for Payment.

1.7.2. The Record Documents Edit Log shall include the following information as a minimum:

1.7.2.1. Date Edited.

1.7.2.2. Name and Company of Person Making Edit.

1.7.2.3. Edit Type: RFI, Change Order/Request for Proposal, Field Change, Red Line,

1.7.2.4. Supplemental Document, and Revision/ASI.

1.7.2.5. Reference: name and number of the source document if applicable, such as Change Order or RFI number.

1.7.2.6. Sheet(s) Edited.

1.8. AS-BUILT DRAWINGS

1.8.1. Contractor must mark-up Drawings that are most compatible for showing actual physical condition, fully and accurately and must reference all other appearances of this Work to the updated sheet. Contractor must include cross-references to the Change Order number on the updated Drawing sheet and all additional sheets where the Work is shown.

1.8.2. Contractor must mark-up with erasable colored pencil, in a legible and professional manner using separate colors where feasible, to distinguish between changes for different categories of Work at the same general location.

1.8.3. Contractor must mark-up important additional information, which was either shown schematically only or omitted from the Construction Documents. Contractor must give particular attention to information on concealed work that would be difficult to identify or measure and record at a later date.

1.8.4. The Contractor shall receive from the Consultant a set of electronic files of the project, with the engineering seal, stamp, signature and Consultant's logo removed.

1.8.5. The Contractor shall use the files as backgrounds on which all the changes recorded during the construction phase shall be transcribed electronically.

- 1.8.6. Once all the changes have been transcribed on the backgrounds, the drawings shall be electronically stamped "AS BUILT DRAWINGS" and shall be converted to pdf format and submitted to the Consultant for review. The Contractor remains responsible for the accuracy of the recorded information.
- 1.8.7. In association with Contractor's request for Substantial Completion inspection, Contractor must submit one (1) electronic copy of the marked-up as-built drawings to Client's representative.

1.9. RECORD SPECIFICATIONS

- 1.9.1. It is mandatory that all changes to specified materials, installation, warranty, etc. be clearly and fully marked within the applicable Specification section in a manner acceptable to the Consultant and Client. Contractor shall review with the Owner and document an acceptable procedure early in the construction phase.
- 1.9.2. Contractor must give particular attention to substitutions, selection of options, and similar information on work where the exact products used are not clearly identified or readily discernible in the original Specifications. When applicable, Contractor must cross-reference related Record Drawing information and product data.
- 1.9.3. Contractor must neatly transcribe and post all marked-up information to a "clean" copy of the Specifications, ensuring that similar types of information are annotated in like fashion throughout the Specifications. The Record Specifications shall then be converted to pdf format and submitted to the Consultant for review. The Contractor remains responsible for the accuracy of Record Specifications content.
- 1.9.4. In association with Contractor's request for Substantial Completion inspection, Contractor must submit the electronic version (pdf) of the Record Specifications to the Client representative.

1.10. OPERATION AND MAINTENANCE MANUALS

- 1.10.1. Submit operations and maintenance and operation data for all required equipment min. 15 days before application for Substantial Completion of the work. Substantial Completion status for the work will not be granted in the absence of full Operations and maintenance Information.
- 1.10.2. Contractor shall furnish the following equipment data content to be Included in Operating and Maintenance Manuals:
 - 1.10.2.1. *Description of Equipment.*
 - 1.10.2.2. *Record Product Submittals.* Clearly identify all options and accessories of actual installed product and variations in the actual Work in comparison with submitted information.

- 1.10.2.3. *Parts List.* Clearly identify every part in the item of equipment with the proper manufacturer's name, part nomenclature and number, local source, and list price.
- 1.10.2.4. *Recommended Spare Parts List.* For each equipment item that Owner will likely need within a 12-month period to support and operate that item of equipment. The quantities of spare parts recommended must be based upon the quantity of like equipment items installed under the Contract Documents.
- 1.10.2.5. *Normal Operating Instructions.* Detailed information to permit a journeyman mechanic to adjust, start-up, operate, and shut down the equipment. Special start-up precautions shall be noted as well as other action items required before the equipment is put into service.
- 1.10.2.6. *Emergency Operating Procedures.* Detailed description of the sequence of action to be taken in the event of a malfunction of the unit, either to permit a short period of continued operation or emergency shutdown to prevent further damage to the unit and to the system in which it is installed.
- 1.10.2.7. *Preventive Maintenance.* Detailed information to cover routine and special inspection requirements, including but not limited to, field adjustments, inspections for wear, adjustment changes, packing wear, lubrication points, frequency and specific lubrication type required, cleaning of the unit and type solvent to use, and such other measures as are applicable to preventive maintenance program.
- 1.10.2.8. *Calibration.* Detailed data on what to calibrate, how to calibrate, when to calibrate and procedures to enable checking the equipment for reliability or indications as well as data for test equipment, special tools and the location of test points.
- 1.10.2.9. *Scale and Corrosion Control.* Detailed information covering the prevention of and removal of scale and corrosion.
- 1.10.2.10. *Trouble Shooting Procedures.* Detailed information and procedures for detecting and isolating malfunctions and detailed information concerning probable causes and applicable remedies.
- 1.10.2.11. *Removal and Installation Instructions.* Detailed information concerning the logical sequence of steps required to remove and install the item including instructions for the use of special tools and equipment.
- 1.10.2.12. *Disassembly and Assembly Instructions.* Detailed illustrations and text to show the logical procedure and provide the instructions necessary to disassemble and assemble the unit properly. The text shall include all checks and special precautions as well as the use of special tools and equipment required to perform the assembly or disassembly.
- 1.10.2.13. *Repair Instructions.* Detailed repair procedures to bring the equipment up to the required operating standard including instruction for examining equipment and parts for needed repairs and adjustments, and tests or inspections required to determine whether old parts may be reused or must be replaced.

- 1.10.2.14. *Special Tools and Test Equipment.* Detailed list of the special tools and test equipment needed to perform repair and maintenance for each equipment item. The list shall contain the special tool and test equipment part number, size, quantity, price, manufacturer's name and address, and local supplier's name and address.
- 1.10.2.15. *System Drawings.* Contractor shall furnish detailed drawings, where applicable, that clearly show wiring diagrams, utility service diagrams, control diagrams, system schematics, pneumatic and fluid flow diagrams, etc., which pertain to the unit function. System drawings must show major pieces of equipment, such as chillers, boilers, heat exchangers, pumps, air handlers, tanks, switchgear, etc., as meaningful to the Project. Fluid flow and direction and valves with their valve tag identification numbers must be clearly noted on drawings. Drawings must show modifications to another manufacturer's standard unit when it is incorporated into the assembly or package unit.

1.10.3. Warranties And Guarantees

- 1.10.3.1. Contractor shall include, within the Operating and Maintenance Manual organizational structure for each system, equipment item, or material, an executed copy of the specified warranty/guarantee with warranty effective dates covering that particular system, equipment item, or material. Contractor shall include the manufacturer's warranty as specified and the installing subcontractor's and supplier's guarantee for workmanship and system operation.

1.10.4. Requirements For Close-Out Manual

- 1.10.4.1. The Commissioning and Close-Out Manual shall include, but is not limited to, the following:
 - 1.10.4.1.1. Commissioning documentation, pre-functional and functional check lists and forms.
 - 1.10.4.1.2. Final air balance reports produced by the Test, Adjust, and Balance Firm.
 - 1.10.4.1.3. Completed Valve Schedule and Fire, Fire/Smoke and Smoke Damper Schedule.
 - 1.10.4.1.4. Owner Demonstration / Training Reports: Contractor shall furnish Training Plan and Documentation of Owner's personnel training regarding operation of systems. Contractor shall include identification of parties receiving training and date(s) of such training.
 - 1.10.4.1.5. Electrical Test Reports (including factory tests and settings).
 - 1.10.4.1.6. Miscellaneous Equipment Test Reports (including factory tests and settings).
 - 1.10.4.1.7. HVAC Calibration Reports (including duct testing reports).
 - 1.10.4.1.8. Fire Alarm Test Reports.
 - 1.10.4.1.9. Piping Test Reports.

1.10.4.1.10. Sewer Video Log.

1.10.4.1.11. Code-required Certifications as described within Technical Specifications.

1.10.4.1.12. Material Safety Data Sheets (MSDS) for any and all products incorporated into the Project.

1.10.5. Miscellaneous Close-out Documents.

1.10.5.1. Contractor shall provide categories of requirements resulting in miscellaneous work records including, but not be limited to, the following:

1.10.5.1.1. Required field records on excavations, foundations, underground construction, wells and similar work.

1.10.5.1.2. Accurate survey showing locations and elevations of underground lines, including invert elevations of drainage piping. Surveys establishing lines and levels of building.

1.10.5.1.3. Certifications received in lieu of labels on products and similar record documentation.

1.10.5.1.4. Testing and qualification of tradesmen.

1.10.5.1.5. Documented qualification of installation firms.

1.10.5.1.6. Materials testing reports.

1.10.5.1.7. Final inspection Punch-list and deficiency corrections.

1.10.5.1.8. All original, signed Project warranties and guarantees.

1.11. MAINTENANCE AND OPERATIONS MANUAL FORMATTING

1.11.1. Provide minimum of two (2) hard copies and one electronic copy of Mechanical Maintenance Manuals, in accordance to the following:

1.11.2. Manuals to be bound in a hard cover neatly labeled: "OPERATING AND MAINTENANCE INSTRUCTIONS".

1.11.3. The Maintenance and Operations Manuals shall be divided into sections with neatly labeled and tabbed dividers between each section. The sections to be included in the manual are:

1.11.3.1. Section I - General.

1.11.3.2. Section II - Piping and Pump Systems, Ductwork and Accessories.

1.11.3.3. Section III - HVAC Equipment/Electrical Equipment

1.11.3.4. Section IV - Automatic Controls

1.11.3.5. Section V - Air and Water Balancing

1.11.4. The following information shall be contained within the sections:

1.11.4.1. SECTION I: A list giving name, address and telephone number of the Consultant, Engineers, General Contractor, Mechanical Trade and Controls Trade. Written

warranties for the Mechanical Systems. A copy of the Valve directory giving number, valve location, normal valve position, and purpose of valve. Equipment lists and certificates shall be provided - certificates shall be signed and sealed by the appropriate suppliers.

- 1.11.4.2. SECTION II, III: A copy of all pressure tests and operational tests. A copy of Gas Operational Tests for gas fired equipment. A list giving name, address and telephone number of all suppliers. Details of chemical treatment equipment and substances. A copy of all reviewed Shop Drawings for all mechanical equipment and ancillary devices (valves, expansion tanks, pumps, strainers, plumbing, etc.). Copies of warranties.
- 1.11.4.3. SECTION IV: Complete Control Diagrams, Wiring Diagrams and description of Control system and the functioning sequence of the system.
- 1.11.4.4. SECTION V: Complete air and hydronic balancing reports.

1.12. WITHHOLDING OF PAYMENT

- 1.12.1. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. REQUIREMENTS INCLUDED	2
1.2. INSTRUCTION OF CLIENT’S OPERATING PERSONNEL	2
1.3. DEFINITIONS	2
1.4. QUALITY ASSURANCE	2
1.5. SUBMITTALS	2
PART 2 - PRODUCTS (NOT APPLICABLE)	3
PART 3 - EXECUTION	3
3.1. PREPARATION FOR FINAL TESTS, DEMONSTRATIONS, AND INSTRUCTIONS	3
3.2. FINAL TESTS	3
3.3. STARTUP AND TESTING	3
3.4. DEMONSTRATIONS AND TRAINING	3
3.5. TIME ALLOCATED FOR DEMONSTRATIONS AND INSTRUCTIONS	4

PART 1 - GENERAL

1.1. REQUIREMENTS INCLUDED

- 1.1.1. Procedures for on-site demonstration and testing of equipment and systems, including temporary facilities.

1.2. INSTRUCTION OF CLIENT'S OPERATING PERSONNEL

- 1.2.1. All demonstrations, instructions and testing must be completed prior to Board acceptance for beneficial use. All safety devices must pass 100 percent before the mechanical systems can be accepted for beneficial use.
- 1.2.2. Plumbing and emergency power systems are not included.

1.3. DEFINITIONS

- 1.3.1. Start Up: Initial inspection, cleaning, lubrication, adjustment, and operation of equipment and systems by the contractor with the assistance of the representatives of the equipment manufacturers.
- 1.3.2. Pre-Tests: The final stage of the startup procedure. This occurs after all adjustments have been made except for minor fine-tuning that can be done during the pre-test. Serves as verification that the systems are ready for the final test. Witnessing of pre-test by the Consultant is not required.
- 1.3.3. Final Tests: Tests, witnessed by the Commissioning Agent or their representative, which demonstrate that all equipment and systems are in compliance with requirements.

1.4. QUALITY ASSURANCE

- 1.4.1. Experienced, trained technical service personnel who are representatives of the equipment manufacturers and system designers shall demonstrate, provide instructions, pre-test and final test, as specified, the following equipment:
 - 1.4.1.1. Water to water heat pumps
 - 1.4.1.2. Circulation Pumps
- 1.4.2. The person responsible for programming the BAS shall demonstrate and provide instructions on hardware, software and programming.
- 1.4.3. The Board will provide a list of personnel to receive instructions and will coordinate their attendance at agreed upon times.
- 1.4.4. All safety devices shall comply with the TSSA requirements.

1.5. SUBMITTALS

- 1.5.1. Names and qualifications of personnel performing demonstrations, instructions and tests.
- 1.5.2. Certification that pre testing is complete.
- 1.5.3. Preliminary schedule of all demonstrations, instructions and final tests two weeks prior to proposed dates.
- 1.5.4. Provide reports within three weeks after satisfactory completion of demonstrations, instructions, and tests. List date, type of work, persons participating, amount of time, test results, calculations of test results, test data.
- 1.5.5. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion,

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1. PREPARATION FOR FINAL TESTS, DEMONSTRATIONS, AND INSTRUCTIONS

- 3.1.1. Verify that equipment and systems are fully operational. Complete all start up and pre-test activities for all equipment and systems. Complete all construction and finish work.
- 3.1.2. Arrange for all test personnel for all equipment to be continuously present during one period of time so that all equipment and systems can be tested in their interrelated functions. For instance, the burner in a heating system shall be tested during the boiler testing, and instrumentation performance will be evaluated in conjunction with boiler testing.
- 3.1.3. Deliver maintenance and operating manuals four weeks prior to instruction period.
- 3.1.4. Furnish all special tools.

3.2. FINAL TESTS

- 3.2.1. Demonstrate proper operation of each equipment and system.
- 3.2.2. Provide tests on equipment as specified in the individual specification sections.

3.3. STARTUP AND TESTING

- 3.3.1. The Consultant will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Consultant. Provide a minimum of 7 days prior notice.

3.4. DEMONSTRATIONS AND TRAINING

- 3.4.1. Demonstrate operation and maintenance of equipment and systems to Board personnel no more than two weeks prior to scheduled Board operation of the equipment.
- 3.4.2. Use operation and maintenance manuals as basis of instruction. Review contents of manuals with personnel in detail to explain all aspects of operation and maintenance.
- 3.4.3. Demonstrate start up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shut down of each item of equipment. Allow Government personnel to practice operating the equipment under supervision of instructors.
- 3.4.4. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.
- 3.4.5. Submit training plans and instructor qualifications

3.5. TIME ALLOCATED FOR DEMONSTRATIONS AND INSTRUCTIONS

- 3.5.1. At least 16 total instructor hours to include all new building services installed under this project.
- 3.5.2. At least 4 total instructor hours to include BAS and computer workstation and programs.
- 3.5.3. Do not exceed three trainees per session, one four-hour session, per day, per trainee.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. DEFINITIONS	2
1.3. WARRANTY	2
1.4. PROTECTION	2
1.5. QUALIFICATIONS.....	4
1.6. EXAMINATION	4
1.7. SCHEDULING	4
1.8. MAINTAINING TRAFFIC.....	4
1.9. HAULING OPERATIONS	4
1.10. INTERRUPTIONS TO CLIENT'S OPERATIONS	5
1.11. SAFETY REQUIREMENTS	5
1.12. WORK INCLUDED IN THIS SECTION	5
PART 2 - PRODUCTS (NOT APPLICABLE).....	6
PART 3 - EXECUTION	6
3.1. GENERAL	6
3.2. DUST CONTROL.....	6
3.3. DISPOSAL	6
3.4. DEMOLITION OF ARCHITECTURAL FINISHES	7
3.5. DEMOLITION OF CONCRETE OR ASPHALT	8

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section specifies demolition and removal of utilities, services and equipment, as noted on the drawings and as required for the completion of the new work.

1.2. DEFINITIONS

- 1.2.1. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- 1.2.2. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse or store as noted on Drawings.
- 1.2.3. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- 1.2.4. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- 1.2.5. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3. WARRANTY

- 1.3.1. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing Warranties include the following:
- 1.3.1.1. Roof system
- 1.3.1.1.1. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.4. PROTECTION

- 1.4.1. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures.
- 1.4.2. Carry out all demolition work in a neat and orderly manner. Keep noise, dust, and similar nuisances to a minimum. Do not collapse walls. Do not throw or drop materials.

- 1.4.3. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.
- 1.4.4. Where material indicated to be removed is suspected of containing asbestos, inform Client's Representative immediately. Do not disturb materials suspected of containing asbestos until asbestos content has been verified by Client.
- 1.4.5. Use extreme caution when cutting into shafts and chases. Shafts and chases may end above occupied areas within building. Take all necessary precautions to prevent debris from falling through openings between floors during demolition operations.
- 1.4.6. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- 1.4.7. Prevent debris from blocking drainage systems (floor drains) or affecting other mechanical and electrical systems that must remain in operation.
- 1.4.8. Protect building floors against damage from demolition work. Use ½" plywood covers over floor where lifting, moving, rolling of removed equipment is anticipated. Be responsible for repairing any damage to flooring caused by the work defined in this section. Execute repairs to the satisfaction of the Board at no cost to the Board.
- 1.4.9. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.
- 1.4.10. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- 1.4.11. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
- 1.4.12. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
- 1.4.13. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

1.4.14. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Client.

1.4.15. Any damaged items shall be repaired or replaced as approved by the Consultant. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required.

1.4.16. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.

1.5. QUALIFICATIONS

1.5.1. Work of this section shall be executed by trades personnel having a minimum of 3 years' experience in the demolition field and capable to deploy adequate equipment as required to complete the work in an efficient and orderly manner.

1.6. EXAMINATION

1.6.1. Examine existing property. Determine the nature of materials to be removed.

1.6.2. When utilities or building services are encountered that are not indicated on the drawings, the Consultant shall be notified prior to further work in that area.

1.7. SCHEDULING

1.7.1. Coordinate the timing and duration of DCW, DHW and power shut-down with the Board representatives.

1.8. MAINTAINING TRAFFIC

1.8.1. Maintain and preserve Board's access requirements within, to and from existing building in areas where demolition and removal work is being carried out.

1.8.2. Do not close, obstruct, place or store material in the building driveways and passageways. Conduct operations with minimum interference with roads, streets, driveways, user traffic and passageways.

1.9. HAULING OPERATIONS

- 1.9.1. Maintain roadways and paving in the hauling areas clean on a daily basis and as required by Municipal Authorities.
- 1.9.2. Parking is not ample or readily available in the area where the building is located. Coordinate delivery of equipment with the Board representatives.
- 1.9.3. Contractor is responsible for all craning & lifting operations. It is the Contractor's responsibility to coordinate with the respective Municipality & pay/obtain all required permits.
- 1.9.4. Contractor is responsible for providing a craning plan for review & approval by the Client.

1.10. INTERRUPTIONS TO CLIENT'S OPERATIONS

- 1.10.1. There will be absolutely no interruptions to the building schedule during demolition work. Therefore, it is imperative that operations and machine and equipment movements, deliveries and removals are executed at time or times that will permit uninterrupted Board's operations in and around the building, including parking, receiving areas, deliveries and site and means of access and egress.
- 1.10.2. Where interruptions of domestic cold and hot water are necessary, coordinate with the School Representatives the timing and duration of such interruptions.

1.11. SAFETY REQUIREMENTS

- 1.11.1. Coordinate posting of danger signs conspicuously around property. Close doorways and thoroughfares giving access to area of demolition with barricades.
- 1.11.2. Provide a competent, experienced supervisor in charge of the Work and on Site while Work is in progress.
- 1.11.3. Should any suspect designated substance not already identified, be encountered, cease work in the immediate area and immediately report, to the Board. Board is responsible for removal of designated substances.

1.12. WORK INCLUDED IN THIS SECTION

- 1.12.1. Demolition work for this project includes but is not limited to the following:
 - 1.12.1.1. As per information on the drawings
- 1.12.2. All cutting and patching associated with the removal of existing water to water heat pumps to be included.
- 1.12.3. The temporary removal of any other building services as required for the installation of the new equipment; upon completion of the work, the relocated equipment shall be

relocated back to the original position or left in the new position, as warranted by the new layout.

- 1.12.4. The removal of the controls shall be done by the controls Contractor. Contractor shall identify and label all controls before demolition, to ensure that all existing equipment that is to remain will not be affected by this work and to ensure proper connection of the new equipment to the school.
- 1.12.5. All existing building services not affected by this work shall be protected and where necessary, maintained operational during and after the demolition work is complete. Any accidental damage or interruption of existing building services not required by this project will be promptly repaired at no additional cost to the Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. At the end of each day's work, leave site in a safe condition and erect safety barriers and lights as required. Ensure that no parts of the existing building are in danger of collapsing.
- 3.1.2. Review the requirements of new equipment to be installed. Perform all demolition work required to allow for the new equipment to be installed, whether shown on the drawings or not.
- 3.1.3. Provide any additional labour, materials and services not specifically indicated on the drawings but required to complete the demolition work.
- 3.1.4. Do not disturb adjacent structures or equipment designated to remain in place.
- 3.1.5. Confine operations and workers to those parts of the building which are defined on the drawings and exercise great care not to damage existing construction beyond that necessary for the carrying out of new work. Make good any such damage in every respect, to the satisfaction of the Client.

3.2. DUST CONTROL

- 3.2.1. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily

3.3. DISPOSAL

3.3.1. Removed Items

- 3.3.1.1. Unless otherwise instructed by the Client's representative, all materials from demolition including brick, concrete, stone, metals, insulation, wiring, tubing and similar materials shall be removed
- 3.3.1.2. Removed items become property of Contractor and shall be disposed of by him daily, off the site to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Consultant. Contractor shall dispose debris in compliance with applicable federal, provincial or local permits, rules and/or regulations.
- 3.3.1.3. Dispose of demolished materials in accordance with the requirements of Authorities Having Jurisdiction. At the end of demolition work, leave site in broom-clean condition. Clean existing surfaces specified to receive new applied finishes to ensure proper adherence.

3.3.2. Removed and Salvaged Items:

- 3.3.2.1. The Board Representative will review the Site prior to commencement of demolition and instruct the Contractor, in writing, as to the items to be Removed and Salvaged. Perform the following:
 - 3.3.2.1.1. Clean salvaged items.
 - 3.3.2.1.2. Pack or crate items after cleaning. Identify contents of containers.
 - 3.3.2.1.3. Store items in a secure area until delivery to Owner.
 - 3.3.2.1.4. Transport items to Owner's storage area location in building.
 - 3.3.2.1.5. Protect items from damage during transport and storage.

3.3.3. Removed and Reinstalled Items:

- 3.3.3.1. Clean and repair items to functional condition adequate for intended reuse.
- 3.3.3.2. Pack or crate items after cleaning and repairing. Identify contents of containers.
- 3.3.3.3. Protect items from damage during transport and storage.
- 3.3.3.4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.3.4. Existing Items to Remain:

- 3.3.4.1. Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner's Representative, items may be removed to a suitable, protected storage location off-site during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.4. **DEMOLITION OF ARCHITECTURAL FINISHES**

3.4.1. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

- 3.4.1.1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
- 3.4.1.2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- 3.4.1.3. Do not use cutting torches without written permission from Client's Representative. Comply with Owner's rules and procedures.
- 3.4.1.4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loading on supporting walls, floors, or framing.
- 3.4.1.5. Dispose of demolished items and materials promptly.
- 3.4.1.6. Remove all loose material from partially demolished work leaving only sound and secure construction.

3.4.2. Plaster:

- 3.4.2.1. Remove loose plaster that will be exposed in finished construction. Loose plaster is defined as plaster material of at least 2 inches by 4 inches in size that can be moved by touch or that sounds hollow when lightly tapped with a hammer.

3.4.3. Flooring:

- 3.4.3.1. Where shown, scheduled or otherwise required for application or installation of new floor finishes or coverings, remove existing flooring tile, resilient sheet flooring as follows:
 - 3.4.3.1.1. Remove all traces of existing flooring materials. Remove resilient sheet and tile flooring products
 - 3.4.3.1.2. Remove adhesives, except those containing asbestos. Use chemical strippers approved by manufacturer of new flooring materials, or grind concrete floor surfaces to completely remove adhesive. Obtain Client's Representative's approval of removal method prior to beginning removal work.
 - 3.4.3.1.3. Do not remove vinyl composition tile or adhesives suspected of containing asbestos. Client will verify asbestos content of questionable materials. Removal of asbestos-containing adhesives (if any) shall be undertaken separately by the Client
 - 3.4.3.1.4. Clean floor slabs of dust and adhesive residue.

3.5. DEMOLITION OF CONCRETE OR ASPHALT

- 3.5.1. Water used during concrete and asphalt work (including sweeping and saw-cutting) must be contained and collected for proper disposal. Do not discharge water containing dust or debris from concrete or asphalt work into storm drains, catch basins or to the sanitary sewer system.

TABLE OF CONTENTS

PART 1 - GENERAL	4
1.1. DESCRIPTION	4
1.2. DEFINITIONS	4
1.3. RELATED WORK	4
1.4. QUALITY ASSURANCE	4
1.5. PRODUCTS CRITERIA.....	4
1.6. EQUIPMENT SERVICE ORGANIZATIONS	5
1.7. EXECUTION (INSTALLATION, CONSTRUCTION) QUALITY	5
1.8. DUTIES OF MECHANICAL CONTRACTOR.....	5
1.9. COMMISSIONING	6
1.10. SCHEDULING OF WORK	6
1.11. INTENT	7
1.12. INTERFERENCES	7
1.13. EXAMINE SITE	8
1.14. INTERFERENCE AND SLEEVING DRAWINGS.....	8
1.15. WARRANTY	8
1.16. SUBMITTALS	8
1.17. MATERIALS AND STANDARDS OF ACCEPTANCE	9
1.18. MATERIAL SUBSTITUTIONS.....	10
1.19. CODES, PERMITS, FEES AND CONNECTIONS	10
1.20. CONSULTANT'S INSTRUCTIONS	11
1.21. ADDITIONAL WORK AND CHANGES	11
1.22. DELIVERY, STORAGE AND HANDLING.....	11
1.23. HAULING OPERATIONS.....	12
1.24. JOB CONDITIONS – WORK IN EXISTING BUILDING	12
PART 2 - PRODUCTS	13
2.1. FACTORY-ASSEMBLED PRODUCTS.....	13
2.2. COMPATIBILITY OF RELATED EQUIPMENT	13
2.3. BELT DRIVES.....	13
2.4. DRIVE GUARDS	14

2.5.	LIFTING ATTACHMENTS.....	15
2.6.	EQUIPMENT REQUIREMENTS AND INSTALLATION	15
2.7.	ELECTRIC MOTORS.....	15
2.8.	VARIABLE SPEED MOTOR CONTROLLERS	16
2.9.	EQUIPMENT AND MATERIALS IDENTIFICATION	16
2.10.	FIRESTOPPING	16
2.11.	GALVANIZED REPAIR COMPOUND	17
2.12.	HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS	17
2.13.	PIPE PENETRATIONS – ROOFS	20
2.14.	PIPE PENETRATIONS THROUGH INTERIOR BUILDING ELEMENTS	20
2.15.	DUCT PENETRATIONS - ROOFS.....	21
2.16.	DUCT PENETRATIONS – INTERIOR BUILDING ELEMENTS	21
2.17.	SPECIAL TOOLS AND LUBRICANTS	21
2.18.	WALL, FLOOR AND CEILING PLATES	22
PART 3 -	EXECUTION	22
3.1.	ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING.....	22
3.2.	THERMOMETERS AND PRESSURE GAUGES	23
3.3.	EQUIPMENT AND PIPING SUPPORT	23
3.4.	ITEMS NOT SHOWN BUT REQUIRED.....	24
3.5.	PROTECTION AND CLEANING	24
3.6.	WORK IN EXISTING BUILDING.....	24
3.7.	TEMPORARY PIPING AND EQUIPMENT	25
3.8.	RIGGING.....	25
3.9.	PIPE AND EQUIPMENT SUPPORTS.....	26
3.10.	CLEANING AND PAINTING	27
3.11.	IDENTIFICATION SIGNS	28
3.12.	MOTOR AND DRIVE ALIGNMENT	28
3.13.	LUBRICATION	28
3.14.	CONCRETE.....	29
3.15.	METALS	29
3.16.	CUTTING, PATCHING, ROOFING, AND X-RAY	29

3.17.	OPERATING AND MAINTENANCE MANUALS	30
3.18.	CLOSE-OUT DOCUMENTATION	30
3.19.	COMMISSIONING	30
3.20.	STARTUP AND TEMPORARY OPERATION	30
3.21.	OPERATING AND PERFORMANCE TESTS	30
3.22.	INSTRUCTIONS TO CLIENT PERSONNEL.....	31

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. The requirements of this Section apply to all sections of Division 23.

1.2. DEFINITIONS

- 1.2.1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
- 1.2.2. Option or optional: Contractor's choice of an alternate material or method.

1.3. RELATED WORK

- 1.3.1. Section: 01 33 23 Shop Drawings, Product Data, and Samples.
- 1.3.2. Section: 23 05 13 Common Motor Requirements for HVAC Equipment.
- 1.3.3. Section: 23 05 48 Vibration and Seismic Controls for HVAC.
- 1.3.4. Section: 23 05 93 Testing, Adjusting and Balancing For HVAC.
- 1.3.5. Section: 23 07 00 HVAC Insulation.

1.4. QUALITY ASSURANCE

- 1.4.1. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC.

1.5. PRODUCTS CRITERIA

- 1.5.1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.
- 1.5.2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.

- 1.5.3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the Consultant.
- 1.5.4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- 1.5.5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
- 1.5.6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
- 1.5.7. Asbestos products or equipment or materials containing asbestos shall not be used.

1.6. EQUIPMENT SERVICE ORGANIZATIONS

- 1.6.1. HVAC: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts.
- 1.6.2. HVAC Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
 - 1.6.2.1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
 - 1.6.2.2. Comply with provisions of ASME B31 series "Code for Pressure Piping".

1.7. EXECUTION (INSTALLATION, CONSTRUCTION) QUALITY

- 1.7.1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Consultant for resolution.
- 1.7.2. Provide complete layout drawings, schematics, diagrams, sections, notes and specifications as required to allow for competitive bidding and construction. Do not commence construction work on any system until the layout drawings have been approved.

1.8. DUTIES OF MECHANICAL CONTRACTOR

- 1.8.1. The mechanical contractor shall assume the responsibilities and duties of a general contractor including but not limited to the ones described below:
 - 1.8.1.1. Superintendence

- 1.8.1.1.1. Provide full time on-site superintendent personnel and supporting staff with proven experience in project of similar value and complexity.
- 1.8.1.1.2. Site superintendent shall have over-all authority to speak for and represent the mechanical contractor.
- 1.8.1.2. Coordination
 - 1.8.1.2.1. Coordinate the work with all the sub-trades involved to ensure that the work will be carried out on schedule and in proper sequence.
 - 1.8.1.2.2. Take complete responsibility for all remedial work that results from failure to coordinate any aspect of the mechanical work prior to its fabrication and/or installation.
 - 1.8.1.2.3. Take responsibility for the delivery of equipment necessary to complete the work in accordance with the approved schedule.
- 1.8.1.3. Staffing and Scheduling
 - 1.8.1.3.1. Within seven days after the award of the contract, the Mechanical Contractor shall provide to the Client representative the following information:
 - Appointment of official representatives in the project.
 - Schedule of work.
 - Delivery schedule for specified equipment.
 - Requirements for temporary facilities, site signs, storage, etc.
- 1.8.1.4. Work Completion Meeting
 - 1.8.1.4.1. Prior to application for Substantial Performance of the Work, the mechanical contractor shall participate in the take-over meeting. Agenda to include the following:
 - Review of outstanding deficiencies.
 - Submission of maintenance manuals, warranties and as-built drawings.
 - Results of performance tests and described further in this section.
 - Scheduling of training to Client's personnel.

1.9. COMMISSIONING

- 1.9.1. The Client may at its discretion use a third party as a commissioning agent for the construction portion of the work. The requirement for commissioning shall be included in the front-end documents of the bidders' package.
- 1.9.2. If commissioning is included, the contractor shall provide all manpower and will take into account all the hours required to participate in the commissioning process including meetings with the commissioning agent, completion of forms and check-lists, verifications, simulations, rectifications of deficiencies and other activities associated with the commissioning process.

1.10. SCHEDULING OF WORK

- 1.10.1. For all work to be performed under this contract, adhere to Construction Schedule agreed upon with the Client.

1.11. INTENT

- 1.11.1. Bidders for this work shall include for all labor, material, equipment and all other related cost including all applicable taxes (except HST) and fees to provide the work as indicated on the drawings.
- 1.11.2. Misinterpretation of any requirement of the drawings and specifications will not relieve the Mechanical Contractor of responsibility. If in any doubt, the Mechanical Contractor shall contact the Consultant for written clarification prior to submitting a bid for the Work.

1.12. INTERFERENCES

- 1.12.1. The mechanical drawings do not show all the architectural and structural details, and any information involving accurate measuring of the building shall be taken from the building drawings or at the building. Make without additional charge, any necessary changes or additions to the runs of drains, pipes, ducts, etc., to accommodate the above conditions. The location of equipment may be altered without charge providing the change is made before installation and does not necessitate major additional material.
- 1.12.2. Field verifications of dimensions on plans shall be made since actual locations, distances, and levels will be governed by actual field conditions.
- 1.12.3. Discrepancies between different plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the Consultant for a decision.
- 1.12.4. Before commencing work, check and verify all grade and invert elevations, stacks, levels, and dimensions, to ensure proper and correct installation of the work.
- 1.12.5. In every place where there is space indicated as reserved for future or other equipment, leave such space clear, install blank offs, shut off valves with blind flanges and other work so that the necessary connections can be made without any stoppages to the system. Consult with the consultant whenever necessary for this purpose.
- 1.12.6. In addition to the work specifically mentioned in the Specifications and shown on the drawings, provide all other items that are obviously necessary to make a complete working installation, including those required by the Authorities Having Jurisdiction over the work.
- 1.12.7. The mechanical plans show approximate locations for wall mounted devices. Obtain Consultant's approval of mounting heights and locations before commencement of work.

1.13. EXAMINE SITE

- 1.13.1. Examine the site and the local conditions affecting the work prior to submission of the tender price. Examine carefully all drawings and the complete specifications. No allowance will be made later for any expenses incurred through the failure to make these examinations or to report any such discrepancies in writing to the Consultant.

1.14. INTERFERENCE AND SLEEVING DRAWINGS

- 1.14.1. Submit complete consolidated and coordinated interference drawings for all new air handling systems, and for existing systems that are in the same areas.
- 1.14.2. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:200. Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, ductwork, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed layout drawings of all piping and duct systems.
- 1.14.3. Do not install equipment foundations, equipment, ductwork or piping until interference drawings have been approved.

1.15. WARRANTY

- 1.15.1. All work completed under this contract shall carry a min. 1 year' warranty (labour and material) from the date of substantial completion.
- 1.15.2. **All equipment supplied under this contract shall carry a 1 year' warranty.** Where certain equipment specifications call for a for a longer warranty on certain components, the longest period shall apply.

1.16. SUBMITTALS

- 1.16.1. Submit documentation in accordance with Section: 01 33 23 Shop Drawings, Product Data, and Samples, and with requirements in the individual specification sections.
- 1.16.2. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- 1.16.3. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- 1.16.4. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and

specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

1.16.5. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient.

1.16.6. Manufacturer's Literature and Data:

- 1.16.6.1. Submit all information pertaining to the performance and capacity of the equipment.
- 1.16.6.2. Submit all information pertaining to methods of connection to piping and ductwork, electrical wiring, controls and noise generated by the equipment (as applicable to the project).
- 1.16.6.3. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the Consultant.
- 1.16.6.4. Submit electric motor data and variable speed drive data with the driven equipment.
- 1.16.6.5. Equipment and materials identification.
- 1.16.6.6. Fire-stopping materials.
- 1.16.6.7. Hangers, inserts, supports and bracing, for both indoor and outdoor installations. Where applicable, provide load ratings and deflection for spring supports and hangers.
- 1.16.6.8. Wall, floor, and ceiling plates.

1.16.7. HVAC Maintenance Data and Operating Instructions:

- 1.16.7.1. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.
- 1.16.7.2. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.17. MATERIALS AND STANDARDS OF ACCEPTANCE

1.17.1. Where materials, equipment, apparatus, or other products are specified by the manufacturer, brand name, type or catalogue number, such designation is to establish standards of desired quality style or dimensions and shall be the basis of the Bid. Materials so specified shall be furnished under this Contract.

1.17.2. Where two or more designations are listed, the contractor shall choose one of those listed and state the choice made on the Bid Form (where applicable). *Note that the basis of*

design equipment has specific physical characteristics in terms of footprint and clearances requirements. Inclusion of a manufacturer other than the one for the Basis of Design in the Standard of Acceptance is not an automatic approval for submission of equipment which cannot be installed due to specific site conditions.

- 1.17.3. *Should the contractor select a approved alternate manufacturer, the contractor remains responsible for all structural, electrical, and mechanical adjustments necessary to install the new equipment.*

1.18. MATERIAL SUBSTITUTIONS

- 1.18.1. After execution of the Contract, requests for substitution of materials or makes other than those specifically named in the Contract Documents may be reviewed and approved by the Consultant, subject to Client's review and acceptance of the financial credits involved.
- 1.18.2. In the absence of such express approval by the Consultant, the Mechanical Contractor will be held to furnish specified items under the base bid as the standard of acceptance.
- 1.18.3. If equipment is submitted which differs in arrangement from that specified/shown on the documents, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

1.19. CODES, PERMITS, FEES AND CONNECTIONS

- 1.19.1. Conform to Federal, Provincial and Municipal regulations and perform work in accordance with requirements of By Laws and Regulations in force in area where the building is to be erected.
- 1.19.2. Apply for, obtain, and pay for all permits, fees and service connections for the work and the inspections required by Authorities Having Jurisdiction in the area where the work will take place
- 1.19.3. Where applicable, apply for, obtain, and pay for all permits, fees and service connections for the work and the inspections required by Authorities Having Jurisdiction in the area where the work will take place, including TSSA and ESA. Where applicable, have the work inspected and certified by PV [Boilers and Pressure Vessels Reg], OE [Operating Engineers Reg.] and FS [Fuel Safety Reg.] branches of TSSA. At the end of the work, the new plant shall be fully TSSA certified.
- 1.19.4. For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.

1.19.5. When part of equipment does not bear the required CSA label, the contractor shall obtain from CSA or Hydro Electric Power Commission, when that part of the equipment is an electric component, a special approval and pay the applicable fees.

1.19.6. Furnish necessary certificates as evidence that the work installed conforms with laws and regulations of Authorities having jurisdiction. Changes in work requested by an Authority having jurisdiction shall be carried out without charge.

1.20. CONSULTANT'S INSTRUCTIONS

1.20.1. During construction the Consultant will issue such instructions as may be necessary for verification and correction of the work. These instructions shall be binding as part of the specification.

1.21. ADDITIONAL WORK AND CHANGES

1.21.1. Unless a written order, reviewed by the Consultant and countersigned or otherwise approved by the Client Representative, no additional work shall be undertaken by the Contractor.

1.22. DELIVERY, STORAGE AND HANDLING

1.22.1. Protection of Equipment:

1.22.1.1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Client has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.

1.22.1.2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Consultant. Such repair or replacement shall be at no additional cost to the Client.

1.22.1.3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

1.22.1.4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

1.22.2. Cleanliness of Piping and Equipment Systems:

1.22.2.1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.

- 1.22.2.2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
- 1.22.2.3. Clean interior of all tanks prior to delivery for beneficial use by the Client.
- 1.22.2.4. Boilers shall be left clean following final internal inspection by Client insurance representative or inspector.
- 1.22.2.5. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.23. HAULING OPERATIONS

- 1.23.1. Maintain roadways and paving in the hauling areas clean on a daily basis and as required by Municipal Authorities.
- 1.23.2. Parking is not ample or readily available in the area where the building is located. Coordinate delivery of equipment with the Client representatives.
- 1.23.3. Contractor is responsible for all craning & lifting operations. It is the Contractor's responsibility to coordinate with the respective Municipality & pay/obtain all required permits.
- 1.23.4. Contractor is responsible for providing a craning plan for review & approval by the Client.

1.24. JOB CONDITIONS – WORK IN EXISTING BUILDING

- 1.24.1. Building Operation: Client employees will be continuously operating and managing all facilities, including temporary facilities, that serve the building.
- 1.24.2. Maintenance of Service: Schedule all work to permit continuous service as required by the Client.
- 1.24.3. Services Interruptions: Limited service interruptions, as required for interconnections of new and existing systems, will be coordinated with the Client and permitted by the Client during the agreed-upon schedule of interruption. Provide at least one week advance notice to the Client representatives.
- 1.24.4. Phasing of Work: Comply with all requirements shown on drawings or specified.
- 1.24.5. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. No storm water or ground water leakage permitted. Provide daily clean up of construction and demolition debris on all floor surfaces and on all equipment being operated by the Client.

- 1.24.6. Acceptance of Work for Client Operation: As new facilities are made available for operation and these facilities are of beneficial use to the Client, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Consultant will process necessary acceptance and the equipment will then be under the control and operation of Client personnel.

PART 2 - PRODUCTS

2.1. FACTORY-ASSEMBLED PRODUCTS

- 2.1.1. Provide maximum standardization of components to reduce spare part requirements.
- 2.1.2. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
- 2.1.3. All components of an assembled unit need not be products of same manufacturer.
- 2.1.4. Constituent parts that are alike shall be products of a single manufacturer.
- 2.1.5. Components shall be compatible with each other and with the total assembly for intended service.
- 2.1.6. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- 2.1.7. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- 2.1.8. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

2.2. COMPATIBILITY OF RELATED EQUIPMENT

- 2.2.1. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3. BELT DRIVES

- 2.3.1. Type: ANSI/RMA standard V belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

- 2.3.2. Dimensions, rating and selection standards: ANSI/RMA IP 20 and IP 21.
- 2.3.3. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.
- 2.3.4. Maximum Speed: 25 m/s (5000 feet per minute).
- 2.3.5. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take up.
- 2.3.6. Drives may utilize a single V Belt (any cross section) when it is the manufacturer's standard.
- 2.3.7. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.
- 2.3.8. Sheaves and Pulleys:
 - 2.3.8.1. Material: Pressed steel, or close grained cast iron.
 - 2.3.8.2. Bore: Fixed or bushing type for securing to shaft with keys.
 - 2.3.8.3. Balanced: Statically and dynamically.
 - 2.3.8.4. roove spacing for driving and driven pulleys shall be the same.
 - 2.3.8.5. Drive Types, Based on ARI 435.
- 2.3.9. Provide adjustable pitch or fixed pitch drive as follows:
 - 2.3.9.1. Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.
 - 2.3.9.2. Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
 - 2.3.9.3. Provide fixed pitch drives for drives larger than those listed above.
- 2.3.10. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable pitch motor sheave or by fan law calculation if a fixed pitch drive is used initially.

2.4. DRIVE GUARDS

- 2.4.1. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.
- 2.4.2. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be

braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

2.4.3. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gage sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (one-inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.

2.4.4. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

2.4.5. Access for Speed Measurement: 25 mm (One inch) diameter hole at each shaft center.

2.5. LIFTING ATTACHMENTS

2.5.1. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.6. EQUIPMENT REQUIREMENTS AND INSTALLATION

2.6.1. Permit equipment maintenance and disassembly by use of unions or flanges to minimize disturbance to connecting piping and duct systems and without interference from building structure or other equipment.

2.6.2. Provide accessible means for lubricating equipment including permanent lubricated bearings.

2.6.3. For all base mounted boilers, pumps, compressors, air handling units, fans and other rotating equipment, provide chamfered edge housekeeping pads a minimum of 4" high and 4" larger than equipment dimensions all around. Work shall be performed by the trades specializing in this work.

2.6.4. Pipe drain lines, overflows and safety relief vents to drains. If the horizontal drains present a tripping hazard, use aluminum checkered plate covers.

2.6.5. Line up equipment, rectangular cleanouts and similar items with building walls wherever possible.

2.7. ELECTRIC MOTORS

2.7.1. All material and equipment furnished and installation methods shall conform to the requirements of Section: 23 05 13 Common Motor Requirements for HVAC Equipment, and Section: 26 05 19 Low-Voltage Electrical Power Conductors and Cables, Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection

and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

2.8. VARIABLE SPEED MOTOR CONTROLLERS

- 2.8.1. Refer to Section: 26 05 00 Common Work Results for Electrical.
- 2.8.2. The combination of controller and motor shall be provided by the manufacturer of the driven equipment, such as pumps and fans, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. air handlers, fans, pumps, shall be product of a single manufacturer.
- 2.8.3. Motors shall be premium efficiency type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.
- 2.8.4. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.
- 2.8.5. Controller shall be provided with the following operating features and accessories:
 - 2.8.5.1. Suitable for variable torque load.
 - 2.8.5.2. Provide thermal magnetic circuit breaker or fused switch with external operator and incoming line fuses. Provide output line reactors on line between drive and motor for motors over 50 HP or where the distance between the breaker and motor exceeds 50 feet.

2.9. EQUIPMENT AND MATERIALS IDENTIFICATION

- 2.9.1. Refer to Section: 23 05 53 Identification for HVAC Piping and Equipment.

2.10. FIRESTOPPING

- 2.10.1. Provide either factory built (Firestop Devices) or field installed (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.
- 2.10.2. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 inches) nominal pipe or 0.01 square meter (16 square inches) in overall cross sectional area.

2.10.3. Firestop sealants used for firestopping or smoke sealing to have the following properties:

- 2.10.3.1. Contain no flammable or toxic solvents.
- 2.10.3.2. Release no dangerous or flammable out gassing during the drying or curing of products.
- 2.10.3.3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
- 2.10.3.4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

2.10.4. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:

- 2.10.4.1. Classified for use with the particular type of penetrating material used.
- 2.10.4.2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.

2.10.5. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.

2.10.6. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

2.10.7. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.

2.10.8. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

- 2.10.8.1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
- 2.10.8.2. For floor penetrations with annular spaces exceeding 101 mm (4 inches) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
- 2.10.8.3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.11. GALVANIZED REPAIR COMPOUND

- 2.11.1. Mil. Spec. DOD P 21035B, paint form.

2.12. HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

2.12.1. Vibration Isolators: Refer to Section: 23 05 48 Vibration and Seismic Controls for HVAC.

2.12.2. Supports for Roof Mounted Items:

2.12.2.1. Equipment: Refer to details on mechanical and structural drawings.

2.12.2.2. Pipe Supports: Refer to details on the drawings.

2.12.2.3. Supports for Indoor Mounted Items

2.12.2.3.1. Attachment to Concrete Building Construction:

- Concrete insert: MSS SP-58, Type 18.
- Self drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the Consultant for each job condition.
- Power driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Consultant for each job condition.

2.12.2.3.2. Attachment to Steel Building Construction:

- Welded attachment: MSS SP 58, Type 22.
- Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C clamp may be used for individual copper tubing up to 23mm (7/8 inch) outside diameter.

2.12.2.3.3. Attachment to existing structure: Support from existing floor/roof frame

- Attachment to Wood Construction: Wood screws or lag bolts.
- Hanger Rods: Hot rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP 58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn buckles shall provide 38 mm (1 1/2 inches) minimum of adjustment and incorporate locknuts. All thread rods are acceptable.

2.12.2.3.4. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1 5/8 inches by 1 5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.

2.12.2.3.5. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).

2.12.2.3.6. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4 inch) U bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2 inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

2.12.3. Supports for Piping Systems:

- 2.12.3.1. Select hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 00 HVAC Insulation for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or pre-insulated calcium silicate shields. Provide Type 40 insulation shield or pre-insulated calcium silicate shield at all other types of supports and hangers including those for pre-insulated piping.
- 2.12.4. Piping Systems (MSS SP 58):
 - 2.12.4.1. Standard clevis hanger: Type 1; provide locknut.
 - 2.12.4.2. Riser clamps: Type 8.
 - 2.12.4.3. Wall brackets: Types 31, 32 or 33.
 - 2.12.4.4. Roller supports: Type 41, 43, 44 and 46.
 - 2.12.4.5. Saddle support: Type 36, 37 or 38.
 - 2.12.4.6. Turnbuckle: Types 13 or 15. Preinsulate.
 - 2.12.4.7. U bolt clamp: Type 24.
- 2.12.5. Copper Tube:
 - 2.12.5.1. Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non-adhesive isolation tape to prevent electrolysis.
 - 2.12.5.2. For vertical runs use epoxy painted or plastic coated riser clamps.
 - 2.12.5.3. For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
- 2.12.6. Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
- 2.12.7. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.
- 2.12.8. Piping with Vertical Expansion and Contraction:
 - 2.12.8.1. Movement up to 20 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
 - 2.12.8.2. Movement more than 20 mm (3/4 inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.
 - 2.12.8.3. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.
- 2.12.9. For pipe sizes larger than (50 mm) 2-inches:
 - 2.12.9.1. Pre-insulated Calcium Silicate Shields:
 - 2.12.9.1.1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.

- 2.12.9.1.2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
- 2.12.9.1.3. Shield thickness shall match the pipe insulation.
- 2.12.9.1.4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
- 2.12.9.1.5. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
- 2.12.9.1.6. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
- 2.12.9.1.7. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces

2.13. PIPE PENETRATIONS – ROOFS

- 2.13.1. Refer to details on the drawings

2.14. PIPE PENETRATIONS THROUGH INTERIOR BUILDING ELEMENTS

- 2.14.1. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- 2.14.2. To prevent accidental liquid spills from passing to a lower level, provide the following:
 - 2.14.2.1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
 - 2.14.2.2. For blocked out floor openings: Provide 40 mm (1½ inch) angle set in silicone adhesive around opening.
 - 2.14.2.3. For drilled penetrations: Provide 40 mm (1½ inch) angle ring or square set in silicone adhesive around penetration.
- 2.14.3. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of Consultant.
- 2.14.4. Sheet Metal, Plastic, or Moisture resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

- 2.14.5. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- 2.14.6. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- 2.14.7. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- 2.14.8. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
- 2.14.9. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

2.15. DUCT PENETRATIONS - ROOFS

- 2.15.1. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 18 inches high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.
- 2.15.2. Refer to details on mechanical and structural drawings.

2.16. DUCT PENETRATIONS – INTERIOR BUILDING ELEMENTS

- 2.16.1. Provide sheet metal sleeves min 150 mm (6") raised above the penetrated floors. Seal space between sleeves and ducts.
- 2.16.2. For penetrations through fire rated building elements, refer to details on the drawings.
- 2.16.3. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly.

2.17. SPECIAL TOOLS AND LUBRICANTS

- 2.17.1. Furnish, and turn over to the Client, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

- 2.17.2. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- 2.17.3. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.
- 2.17.4. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Consultant.
- 2.17.5. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.18. WALL, FLOOR AND CEILING PLATES

- 2.18.1. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- 2.18.2. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3 inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- 2.18.3. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

PART 3 - EXECUTION

3.1. ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

- 3.1.1. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Submit the interference drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- 3.1.2. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, temperature but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent

platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

3.2. THERMOMETERS AND PRESSURE GAUGES

3.2.1. General:

- 3.2.1.1. Locate direct reading thermometers and gauges for reading from floor or platform.
- 3.2.1.2. Provide remote reading thermometers and gauges where direct reading instruments cannot be satisfactorily located.
- 3.2.1.3. Locate engraved lamacoid nameplate as specified in Section Identification, identifying medium adjacent to thermometers and gauges.

3.2.2. Thermometers:

- 3.2.2.1. Industrial, 9" adjustable angle cast aluminum case, CGSB standard CAN/CGSB-14.4-M88 red reading mercury, lens front tube, white scale black embossed figures, clear glass or acrylic window, tapered aluminum stem.
- 3.2.2.2. Scale shall be suitable for 2 times the temperature range of service. Scale shall be combined Celsius and Fahrenheit.
- 3.2.2.3. Standard of Acceptance: Weiss, Ashcroft, Terice.

3.2.3. Pressure Gauges:

- 3.2.3.1. 5" dial, solid front blow out back, fibreglass reinforced polypropylene case, phosphor bronze bourdon tube and brass 1/4" N.P.T. socket, bottom connection, stainless steel rotary type movement, gauge to be registered with the Provincial Boiler and Pressure Vessel Safety Branch with a registration number and conform to ANSI B40.1. Accuracy to be grade "A".
- 3.2.3.2. On pumps liquid filled gauges shall be utilized.
- 3.2.3.3. Standard of Acceptance: Weiss, Ashcroft, Terice.
- 3.2.3.4. Provide bronze stop cock, bronze bar stock 1/4" N.P.T. bronze porous core pressure snubber for pulsating operation and diaphragm for corrosive service.
- 3.2.3.5. Use materials compatible with system requirements.

3.2.4. Gauges shall have combined kilopascal and psi scales.

3.3. EQUIPMENT AND PIPING SUPPORT

- 3.3.1. Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.
- 3.3.2. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

3.3.3. Cutting Holes:

- 3.3.3.1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by Consultant where working area space is limited.
- 3.3.3.2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by Consultant. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to Consultant for approval.
- 3.3.3.3. Do not penetrate membrane waterproofing.

3.4. ITEMS NOT SHOWN BUT REQUIRED

- 3.4.1. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- 3.4.2. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- 3.4.3. Electrical and Pneumatic Interconnection of Controls and Instruments: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.

3.5. PROTECTION AND CLEANING

- 3.5.1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Consultant. Damaged or defective items in the opinion of the Consultant, shall be replaced.
- 3.5.2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

3.6. WORK IN EXISTING BUILDING

- 3.6.1. Make alterations to existing service piping at times that will least interfere with normal operation of the facility.
- 3.6.2. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Client. Locate

openings that will least effect structural slabs, columns, ribs or beams. Refer to the Consultant for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Consultant's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

- 3.6.3. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 ft.) above the equipment to ceiling structure, whichever is lower (NFPA 70).

3.6.4. Inaccessible Equipment:

- 3.6.4.1. Where the Client determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Client.
- 3.6.4.2. The term "conveniently accessible" is defined as capable of being reached without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.7. TEMPORARY PIPING AND EQUIPMENT

- 3.7.1. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.
- 3.7.2. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities.
- 3.7.3. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.8. RIGGING

- 3.8.1. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

- 3.8.2. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Client under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.
- 3.8.3. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Client operation and maintenance of service.
- 3.8.4. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Client will check structure adequacy and advise Contractor of recommended restrictions.
- 3.8.5. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- 3.8.6. Rigging plan and methods shall be referred to Consultant for evaluation prior to actual work.
- 3.8.7. Restore building to original condition upon completion of rigging work.

3.9. PIPE AND EQUIPMENT SUPPORTS

- 3.9.1. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Consultant.
- 3.9.2. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.
- 3.9.3. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work.
- 3.9.4. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP 69. Provide additional supports at valves, strainers, in line pumps and other heavy components. Provide a support within one foot of each elbow.
- 3.9.5. HVAC Vertical Pipe Supports:
 - 3.9.5.1. Up to 150 mm (6 inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.

- 3.9.5.2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.
- 3.9.6. Overhead Supports:
 - 3.9.6.1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
 - 3.9.6.2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
- 3.9.7. Tubing and capillary systems shall be supported in channel troughs.
- 3.9.8. Floor Supports:
 - 3.9.8.1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Anchor and dowel concrete bases and structural systems to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
 - 3.9.8.2. Do not locate or install bases and supports until equipment mounted thereon has been approved. Size bases to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Boiler foundations shall have horizontal dimensions that exceed boiler base frame dimensions by at least 150 mm (6 inches) on all sides. Refer to structural drawings. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
- 3.9.9. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.

3.10. CLEANING AND PAINTING

- 3.10.1. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Client, the plant facilities, equipment and systems shall be thoroughly cleaned and painted.
- 3.10.2. At the completion of the project, clean and prepare all floors in the fan rooms for painting. Cover the entire floors for the mechanical room (in the area of work) with two coats of urethane-based paint (colour: battleship gray).
- 3.10.3. In addition, the following special conditions apply:
 - 3.10.3.1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior

to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.

3.10.4. Material And Equipment Not To Be Painted Includes:

- 3.10.4.1. Motors, controllers, control switches, and safety switches.
- 3.10.4.2. Control and interlock devices.
- 3.10.4.3. Regulators.
- 3.10.4.4. Pressure reducing valves.
- 3.10.4.5. Control valves and thermostatic elements.
- 3.10.4.6. Lubrication devices and grease fittings.
- 3.10.4.7. Copper, brass, aluminum, stainless steel and bronze surfaces.
- 3.10.4.8. Valve stems and rotating shafts.
- 3.10.4.9. Pressure gauges and thermometers.
- 3.10.4.10. Glass.
- 3.10.4.11. Name plates.

3.10.5. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.

3.10.6. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer

3.10.7. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.

3.10.8. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

3.11. IDENTIFICATION SIGNS

3.11.1. Refer to Section: 23 05 53 Identification for HVAC Piping and Equipment.

3.12. MOTOR AND DRIVE ALIGNMENT

3.12.1. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

3.12.2. Direct connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.13. LUBRICATION

3.13.1. Lubricate all devices requiring lubrication prior to initial operation. Field-check all devices for proper lubrication.

3.13.2. Equip all devices with required lubrication fittings or devices. Provide a minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to Consultant in unopened containers that are properly identified as to application.

3.13.3. Provide a separate grease gun with attachments for applicable fittings for each type of grease applied.

3.13.4. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

3.14. CONCRETE

3.14.1. All concrete work required to complete this project, whether shown on the drawings or not, shall be the Contractor's responsibility.

3.14.2. Refer to this specification section for requirements for housekeeping pad.

3.15. METALS

3.15.1. All steel construction required for the completion of this project, whether shown on the drawings or not, shall be the Contractor's responsibility.

3.16. CUTTING, PATCHING, ROOFING, AND X-RAY

3.16.1. All cutting, patching, roofing and X-Rays required for the completion of this project whether shown on the drawings or not, shall be the Contractor's responsibility. The cutting and patching work shall be performed in accordance with the following:

- 3.16.1.1. All cutting and patching shall be done by the trades specializing in the materials to be cut.
- 3.16.1.2. All flashing and equipment supports on the roof shall be done in strict accordance with the Client standards by Client-approved roofing contractors only.
- 3.16.1.3. Should any cutting, roofing and/or repairing of finished surfaces be required, the Sub-trade contractor for the Contractor shall employ the particular trades engaged on the site for this type of work.
- 3.16.1.4. None of the roofing work shall affect any current roof warranty. Coordinate with the Client representative the status of the roof, and if under warranty, coordinate all the work with the warranty holder.
- 3.16.1.5. Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as approved by the Consultant.
- 3.16.1.6. Where slabs in the portions of the building which are existing must be saw-cut or core drilled, all locations shall be x-rayed prior to saw-cutting or core-drilling. All x-raying shall be done by personnel qualified in the use of the type of equipment

required to x-ray the saw-cuts shall be permitted to perform this work on the site. No allowance will be made later for expenses incurred through the failure of performing these x-rays.

3.17. OPERATING AND MAINTENANCE MANUALS

3.17.1. Refer to Section: 01 33 23 Shop Drawings, Product Data, and Samples.

3.18. CLOSE-OUT DOCUMENTATION

3.18.1. 10 (ten) days prior to substantial performance of work obtain documentation and/or prepare certification of the following items and submit them to the Client representative:

- 3.18.1.1. All inspection certificates.
- 3.18.1.2. Guarantee certificates as called for under "Warranty".
- 3.18.1.3. Record drawings.
- 3.18.1.4. Operating and Maintenance Manuals.
- 3.18.1.5. Test certifications as called for under "Testing".
- 3.18.1.6. Provide a signed statement to the effect that all tests for mechanical systems and equipment have been completely carried out in the Trade Sections of these Specifications and to the manufacturer's recommendations, and in accordance with the requirements of all authorities having jurisdiction.

3.19. COMMISSIONING

3.19.1. Where applicable and the commissioning process is part of the project, provide commissioning documentation and all the manpower required for all inspection, start up, and contractor testing required above and required by the Checklists provided by the Commissioning Agent.

3.19.2. Coordinate with the Commissioning Agent if the start up and operation of the installed equipment is part of larger systems which require additional testing and verification.

3.20. STARTUP AND TEMPORARY OPERATION

3.20.1. Startup equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation.

3.21. OPERATING AND PERFORMANCE TESTS

3.21.1. Prior to the final inspection, perform required tests as specified and submit the test reports and records to the Consultant. The timing of the tests shall be arranged to suit the convenience of the Consultant, and the manner and duration shall be as the Consultant deems necessary. Record the daily start and stop times, operating hours and functions performed. Ensure that the performance tests are witnessed by the Consultant.

3.21.2. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Client.

3.21.3. At the successful completion of Performance Tests and all testing and balancing, make the systems ready for final inspection and subsequent acceptance of the Client. Replace and clean filters, flush out lines and equipment, remove and clean strainers, fill liquid systems and purge air. Provide water treatment to pipes and report in accordance to current by-laws. Disinfect all domestic water as required by current by-laws and Authorities Having Jurisdiction.

3.21.4. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.22. INSTRUCTIONS TO CLIENT PERSONNEL

3.22.1. Provide in accordance with Section: 01 79 00 Demonstration and Training.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. SUBMITTALS	2
1.4. APPLICABLE PUBLICATIONS	2
1.5. STANDARDS OF ACCEPTANCE	3
PART 2 - PRODUCTS	3
2.1. MOTORS	3
2.2. MOTOR ENCLOSURES	4
2.3. ENERGY EFFICIENT MOTORS (MOTOR EFFICIENCIES):	6
PART 3 - EXECUTION	7
3.1. INSTALLATION.....	7
3.2. FIELD TESTS.....	7
3.3. STARTUP AND TESTING	7

PART 1 - GENERAL**1.1. DESCRIPTION**

- 1.1.1. This section specifies the furnishing, installation and connection of motors for HVAC equipment.

1.2. RELATED WORK

- 1.2.1. Section: 01 33 23 Shop Drawings, Product Data, and Samples.
- 1.2.2. Section: 23 05 00 Common Work Results for HVAC.
- 1.2.3. Section: 26 05 00 Common Work Results for Electrical.
- 1.2.4. Section: 26 05 19 Low-Voltage Electrical Power Conductors and Cables.

1.3. SUBMITTALS

- 1.3.1. Submit in accordance with Section: 01 33 23 Shop Drawings, Product Data, and Samples, and Section: 26 05 00 Common Work Results for Electrical.
- 1.3.2. Shop Drawings:
 - 1.3.2.1. Provide documentation to demonstrate compliance with drawings and specifications.
 - 1.3.2.2. Include electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
- 1.3.3. Manuals:
 - 1.3.3.1. Submit simultaneously with the shop drawings, companion copies of complete installation, maintenance and operating manuals, including technical data sheets and application data.
 - 1.3.3.2. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certification to the Resident Engineer:
 - 1.3.3.3. Certification that the motors have been applied, installed, adjusted, lubricated, and tested according to manufacturer published recommendations.

1.4. APPLICABLE PUBLICATIONS

- 1.4.1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- 1.4.2. National Electrical Manufacturers Association (NEMA):

- 1.4.2.1. MG 1-2006 Rev. 1 2009 Motors and Generators
- 1.4.2.2. MG 2-2001 Rev. 1 2007 Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators
- 1.4.3. National Fire Protection Association (NFPA):
 - 1.4.3.1. 70-latest National Electrical Code (NEC)
- 1.4.4. Institute of Electrical and Electronics Engineers (IEEE):
 - 1.4.4.1. 112-04 Standard Test Procedure for Polyphase Induction Motors and Generators
- 1.4.5. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - 1.4.5.1. 90.1-latest Energy Standard for Buildings Except Low-Rise Residential Buildings

1.5. STANDARDS OF ACCEPTANCE

- 1.5.1. Baldor Electric Company
- 1.5.2. Leeson Electric
- 1.5.3. General Electric
- 1.5.4. Dayton

PART 2 - PRODUCTS

2.1. MOTORS

- 2.1.1. All material and equipment furnished and installation methods shall conform to the requirements of Section: 26 29 10 Motor Starters to 600 V and Section: 26 05 19 Low-Voltage Electrical Power Conductors and Cables (600 VOLTS AND BELOW). Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors as scheduled. Unless otherwise specified for a particular application, use electric motors with the following requirements.
- 2.1.2. Single phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.
- 2.1.3. Electrically Commutated motor (EC Type): Motor shall be brushless DC type specifically designed for applications with heavy duty ball bearings and electronic commutation. The motor shall be speed controllable down to 20% of full speed and 85% efficient at all speeds.

- 2.1.4. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.
- 2.1.5. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.
- 2.1.6. Number of phases shall be as follows:
 - 2.1.6.1. Motors, less than 373 W (1/2 HP): Single phase.
 - 2.1.6.2. Motors, 373 W (1/2 HP) and larger: 3 phase.
 - 2.1.6.3. Exceptions:
 - 2.1.6.3.1. Hermetically sealed motors.
 - 2.1.6.3.2. Where specified otherwise on the equipment schedules
 - 2.1.6.3.3. Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.
- 2.1.7. Motors shall be designed for operating the connected loads continuously in a 40°C (104°F) environment, where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation. If the motors exceed 40°C (104°F), the motors shall be rated for the actual ambient temperatures.
- 2.1.8. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.

2.2. MOTOR ENCLOSURES

- 2.2.1. Shall be the NEMA types as specified and/or shown on the drawings.
- 2.2.2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.
- 2.2.3. Enclosure requirements for certain conditions are as follows:
 - 2.2.3.1. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
 - 2.2.3.2. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
 - 2.2.3.3. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.
 - 2.2.3.4. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.
- 2.2.4. Special Requirements:

- 2.2.4.1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional time or cost to the Client.
- 2.2.4.2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
- 2.2.5. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
 - 2.2.5.1. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
 - 2.2.5.2. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
 - 2.2.5.3. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
- 2.2.6. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
- 2.2.7. Motors less than 3 HP:
 - 2.2.7.1. Steel or cast iron motor frames, cast aluminum, cast iron, or steel end plates, steel or cast iron terminal box, copper windings. Motor nameplates shall be steel, engraved-type, riveted to motor.
 - 2.2.7.2. Bearings: Regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings, selected for a minimum L-10 bearing life of 26,280 hours, for belted and direct drive.
- 2.2.8. Motors 3 HP and above:
 - 2.2.8.1. Cast iron motor frame and mounting feet, cast iron end plates (bells), steel or cast iron terminal box, copper windings. Motor nameplates shall be stainless steel engraved type, riveted to the motor.
 - 2.2.8.2. Bearings shall be regreasable with relief plugs, pre-lubricated ball bearings suitable for radial and thrust loading of the application, with grease fittings. Rated for an L-10 life of 40,000 hours (belted) or 130,000 hours (direct connected).
- 2.2.9. Bearing life calculations shall be per ABMA 9, and for belted applications shall be based on the maximum external side load limits for belted applications per NEMA MG-1 Table 14-1A. L-10 life calculations for vertical motors and horizontal motors mounted in the vertical position shall consider the application's thrust loading.
- 2.2.10. TEFC motors shall also include an external shaft slinger on drive end.

2.2.11. Motors shall not exceed dBA levels listed in NEMA MG-1 54 PART 9 Tables 9-1 and 9-3, at all speeds.

2.2.12. Motors utilized with variable frequency drives shall be rated “inverter-duty” per NEMA Standard, MG1, Part 31.4.4.2. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

2.3. ENERGY EFFICIENT MOTORS (MOTOR EFFICIENCIES):

2.3.1. All permanently wired polyphase motors of 746 Watts (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table.

2.3.2. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated.

2.3.3. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Premium Efficiencies				Minimum Premium Efficiencies			
Open Drip-Proof				Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%

22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%

2.3.4. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

PART 3 - EXECUTION

3.1. INSTALLATION

Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2. FIELD TESTS

- 3.2.1. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before start-up. All shall test free from grounds.
- 3.2.2. Perform Load test in accordance with ANSI/IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.
- 3.2.3. Insulation Resistance: Not less than one half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.
- 3.2.4. All test data shall be compiled into a report form for each motor and provided to the contracting officer or their representative.

3.3. STARTUP AND TESTING

- 3.3.1. The Commissioning Agent will observe startup and contractor testing of all equipment. Coordinate the startup and contractor testing schedules with Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. SUBMITTALS	2
1.4. APPLICABLE PUBLICATIONS	2
1.5. SCOPE OF WORK	2
1.6. QUALITY ASSURANCE	2
1.7. ACCEPTABLE MANUFACTURERS	3
PART 2 - PRODUCTS	3
2.1. SUSPENDED VIBRATION ISOLATION	3
2.2. FLOOR MOUNTED VIBRATION ISOLATION	5
2.3. PIPING CONNECTIONS	8
2.4. DUCTWORK CONNECTIONS	9
PART 3 - EXECUTION	9
3.1. GENERAL	9
3.2. FLOOR MOUNTED PUMPS	10
3.3. FLOOR MOUNTED BOILERS	10
3.4. FLOOR MOUNTED FANS AND AIR HANDLING EQUIPMENT	10
3.5. FLOOR OR ROOF MOUNTED CHILLERS/COOLING TOWERS	10
3.6. PIPING ISOLATION	11
3.7. CEILING SUSPENDED EQUIPMENT	11
3.8. AIR COOLED CONDENSING UNITS	11
3.9. AIR COOLED CONDENSING UNITS	11
3.10. ROOFTOP AIR HANDLING UNITS AND UTILITY TYPE EXHAUST FANS	11
3.11. DUCT CONNECTORS	11
3.12. ELECTRICAL CONNECTIONS	11
3.13. INSPECTION	12

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section specifies the application of noise and vibration control techniques to boiler plant rotating equipment including pumps, fans, compressors and motors.

1.2. RELATED WORK

- 1.2.1. Section: 01 33 23 Shop Drawings, Product Data, and Samples.

1.3. SUBMITTALS

- 1.3.1. Submit in accordance with Section: 01 33 23 Shop Drawings, Product Data, and Samples.
 - 1.3.1.1. Noise and Vibration Control Devices; include with the equipment submittals.
 - 1.3.1.2. Provide separate shop drawings for each isolated system complete with performance and product data.
 - 1.3.1.3. Submit type of isolator, size, height when uncompressed and maximum allowable static deflection weight of all isolated equipment, loads on each isolator and static deflection of each isolator under the specific design load.
 - 1.3.1.4. Submit marked up plans indicating all locations where pipes are to be isolated in mechanical rooms and as specified.

1.4. APPLICABLE PUBLICATIONS

- 1.4.1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- 1.4.2. ASHRAE - 1995 - HVAC Applications, Chapter 43 - "Sound and Vibration Control".

1.5. SCOPE OF WORK

- 1.5.1. Provide vibration control items for isolating vibration of mechanical equipment, piping and ductwork.
- 1.5.2. Provide all hangers, isolators, bases, pads, sleeves and other devices specified, required, or detailed for the project. Include all vibration isolation system elements as recommended by the equipment manufacturer's representative to make a complete, correct and safe installation. Supply and install all incidental materials needed.

1.6. QUALITY ASSURANCE

- 1.6.1. Work of this section shall be performed by skilled workers who are experienced in the necessary crafts to meet the requirements of this Section.

- 1.6.2. Provide field supervision and inspection to assure proper installation, adjustment and performance. Replace any isolators that are found to resonate with the supported equipment.
- 1.6.3. As a minimum provide vibration control per ASHRAE - 1995 - HVAC Applications, Chapter 43 - "Sound and Vibration Control".
- 1.6.4. Isolators shall be selected, installed and adjusted to prevent the transmission of objectionable vibration and noise to the building structure.
- 1.6.5. The size and number of mounts and hangers shall be chosen to meet these specifications, even if not specifically shown on the plans. Brackets, rails, bases, braces, etc., shall be provided as needed for a complete and correct installation.

1.7. ACCEPTABLE MANUFACTURERS

- 1.7.1. Subject to compliance with the Contract Documents, manufacturers for products specified in this Section shall be one of the following:
 - 1.7.1.1. Kinetics Noise Controls.
 - 1.7.1.2. Mason Industries, Inc.
 - 1.7.1.3. Vibron Ltd.

PART 2 - PRODUCTS

2.1. SUSPENDED VIBRATION ISOLATION

2.1.1. Combination isolation hanger assembly with neoprene insert

- 2.1.1.1. Vibration isolators for suspended equipment with minimum static deflection requirement exceeding 0.4" (10 mm), and where both high and low frequency vibrations are to be isolated, shall be hangers consisting of a laterally stable spring in series with an elastomer-in-shear insert complete with load transfer plates and assembled in a stamped or welded steel bracket.
- 2.1.1.2. The bracket shall be finished with an polyester powder coating. The manufacturer shall provide independent laboratory testing showing that the bracket with this finish has endured a minimum of 1,000 hours of exposure to salt spray fog testing per ASTM B117 without signs of corrosion.
- 2.1.1.3. The elastomer insert shall be molded from oil-resistant compounds and shall be color coded to indicate load capacity and selected to operate within its published load range.
- 2.1.1.4. The spring element shall have a minimum lateral stiffness of 1.0 times the rated vertical stiffness.
- 2.1.1.5. Springs shall be color coded or otherwise identified to indicate load capacity.

- 2.1.1.6. The hanger bracket shall be designed to carry a 500% overload without failure and to allow a support rod misalignment through a 30° arc without metal-to-metal contact or other short circuit.
 - 2.1.1.7. The 1" and 2" hanger brackets shall incorporate spring caps with indexed steps which correspond to the washer diameter of appropriately sized hanger rod to keep the rod centered in the spring cap and reduce rod misalignment. The spring caps are protected under U.S. patent number 5,653,426.
 - 2.1.1.8. Isolation hangers shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the Vibration Isolation Schedule or as indicated on the project documents.
 - 2.1.1.9. *Applications: Suspended mechanical equipment such as in-line fans, cabinet fans, and piping and ductwork in close proximity to mechanical equipment.*
 - 2.1.1.10. Standard of Acceptance: Kinetics Noise Control SRH series.
- 2.1.2. Neoprene Isolation Hangers
- 2.1.2.1. Vibration isolators with maximum static deflection requirements under operating load conditions not exceeding 0.57" (15 mm) shall be hangers consisting of an elastomer-in-shear insert encased in a welded steel bracket and provided with a stamped load transfer cap.
 - 2.1.2.2. The elastomer insert shall be molded from oil resistant compounds, shall be color coded to indicate load capacity and selected to operate within its published load range.
 - 2.1.2.3. The hanger bracket shall be designed to carry a 500% overload without failure and to allow support rod misalignment through a 30° arc without metal-to-metal contact or other short circuit.
 - 2.1.2.4. Isolation hangers shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the Vibration Isolation Schedule or as indicated on the project documents.
 - 2.1.2.5. *Applications: isolation of vibration produced by suspended mechanical equipment, in-line and exhaust fans, ductwork, piping.*
 - 2.1.2.6. Standard of Acceptance: Kinetics Noise Control SRH series.
- 2.1.3. Piping Hangers Spring Vibration isolators
- 2.1.3.1. Vibration isolators for suspended equipment with minimum static deflection requirement exceeding 0.4" (10 mm), and where both high and low frequency vibrations are to be isolated, shall be hangers consisting of a laterally stable spring in series with an elastomer-in-shear insert complete with load transfer plates and assembled in a stamped or welded steel bracket.
 - 2.1.3.2. The bracket shall be finished with a polyester powder coating. The manufacturer shall provide independent laboratory testing showing that the bracket with this

finish has endured a minimum of 1,000 hours of exposure to salt spray fog testing per ASTM B117 without signs of corrosion.

- 2.1.3.3. The elastomer insert shall be molded from oil-resistant compounds and shall be color coded to indicate load capacity and selected to operate within its published load range.
- 2.1.3.4. The spring element shall have a minimum lateral stiffness of 1.0 times the rated vertical stiffness.
- 2.1.3.5. Springs shall be color coded or otherwise identified to indicate load capacity.
- 2.1.3.6. The hanger bracket shall be designed to carry a 500% overload without failure and to allow a support rod misalignment through a 30° arc without metal-to-metal contact or other short circuit.
- 2.1.3.7. The 1" and 2" hanger brackets shall incorporate spring caps with indexed steps which correspond to the washer diameter of appropriately sized hanger rod to keep the rod centered in the spring cap and reduce rod misalignment. The spring caps are protected under U.S. patent number 5,653,426.
- 2.1.3.8. Isolation hangers shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the Vibration Isolation Schedule or as indicated on the project documents.
- 2.1.3.9. *Application: first three pipe hangers upstream/downstream of pumping equipment.*
- 2.1.3.10. The combination isolation hanger assembly with neoprene insert shall be Model SRH, as manufactured by Kinetics Noise Control, Inc.

2.2. FLOOR MOUNTED VIBRATION ISOLATION

2.2.1. Restrained Spring Isolators

- 2.2.1.1. Vibration isolators for equipment which is subject to load variations and large external or torquing forces shall consist of large diameter laterally stabile steel springs assembled into welded steel housing assemblies designed to limit vertical movement of the supported equipment.
- 2.2.1.2. Housing assemblies shall be fabricated steel members and shall consist of a top load plate complete with adjusting and leveling bolts, vertical restraints, isolation washers and a bottom plate with internal non-skid noise isolation pads. Housing shall be electrozinc plated or hot dip galvanized for corrosion resistance. Housing should be designed to provide a constant free and operating height within 1/8" (0.06 mm).
- 2.2.1.3. Spring elements shall have a lateral stiffness greater than 1.2 times the rated vertical stiffness and shall be designed to provide a minimum of 50% overload capacity. Non-welded spring elements shall be polyester powder coated, and shall have a 1000 hr rating when tested in accordance with ASTM B-117.

- 2.2.1.4. All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability. Laterally stable springs shall have k_x/k_y ratios of at least 0.9. All springs shall be fully color-coded to indicate capacity – color striping is not considered adequate.
 - 2.2.1.5. Corrosion Protection: All springs shall be powder-coated enamel. Housings shall be galvanized, powder-coated enamel, or painted with rust-resistant paint. Hot-dipped galvanized housings shall be provided as indicated on the Schedule
 - 2.2.1.6. Operating static deflections are available up to 4" (102 mm) to compensate for long span flexible floor structures and maintain a high degree of noise and vibration isolation.
 - 2.2.1.7. Springs shall be selected to provide maximum deflections; select from manufacturer's literature based on supported equipment weight. Springs shall be color coded or otherwise identified to indicate load capacity.
 - 2.2.1.8. *Vertically restrained spring isolation mounts are recommended as a noise and vibration isolator for heavy mechanical equipment, or when the equipment to be isolated has significant changes of weight during maintenance operations, and for equipment subjected to moderate external forces or wind loads, such as chillers, cooling towers, condensing units larger than 50 ton capacity, air handlers and utility type exhaust fans larger than 10,000 cfm capacity, and similar.*
 - 2.2.1.9. Standards of Acceptance: Kinetics Noise Controls FRS (supported weight up to 1,500 kg) or FLS series (supported equipment weight above 1,500 kg).
- 2.2.2. Neoprene Isolation Pads
- 2.2.2.1. Isolation pads shall be single ribbed or crossed, double ribbed elastomer-in-shear pads, in combination with steel shims when required, having maximum deflections between 0.08" to 0.14"
 - 2.2.2.2. All pads shall be true elastomer-in-shear using alternately higher and lower ribs to provide effective vibration isolation, and shall be molded using 2500 PSI (176 kg/cm²) tensile strength, oil resistant compounds with no color additives.
 - 2.2.2.3. Pads shall be 45 to 65 durometer and designed to permit 60 or 120 PSI (4.2 or 8.4 kg/cm²) loading at maximum rated deflections.
 - 2.2.2.4. When two isolation pads are laminated, they shall be separated by, and bonded to, a galvanized steel shim plate.
 - 2.2.2.5. *Application: floor/concrete curb/sleeper mounted equipment such as boilers pumps, utility type exhaust fans of less than 10,000 cfm capacity, condensing units of less than 50 ton capacity, condensers/fluid coolers, and similar*
 - 2.2.2.6. Standard of Acceptance: Kinetics Noise Control models NPS, NPD, NGS or NGD to suit weight of equipment and max. deflection rates.

2.2.3. Elastomeric Isolation Mounts

- 2.2.3.1. One-piece molded neoprene mounts with encapsulated metal inserts, color coded to identify capacity, with non-skid ribs on the bottom load surfaces. Each isolator incorporates two bolt-down holes on the bottom load surface and a tapped steel load top plate for attachment to the supported equipment. The neoprene is highly oil resistant and has been designed to operate within the strain limits of the isolator to provide maximum isolation and longest life expectancy possible using neoprene compounds.
- 2.2.3.2. *Isolation mounts are designed for up to 0.5" (13 mm) deflection, available in four sizes and eleven capacities from 55 lbs. to 4,000 lbs. (25 kg to 1814 kg).*
- 2.2.3.3. Standard of Acceptance: Kinetics Noise Control model RDS.

2.2.4. Inertia Base Pads

- 2.2.4.1. Isolation bases shall be constructed of concrete cast into fabricated inertia base frames, the steel members of which are designed and supplied by the isolator manufacturer. The concrete shall be poured into a welded steel frame, incorporating prelocated equipment anchor bolts, 1/2-in (13 mm) diameter reinforcing bars on nominal 8-in (203 mm) centers each way, and recessed isolator mounting brackets to reduce the mounting height of the equipment, and reduce the footprint of the base. The thickness of the base shall be a minimum of 8% of the longest span between isolators, at least 6 in (152 mm), or as indicated on the drawings. Where inertia bases are used to mount pumps, the bases shall be sized to support piping elbows.
- 2.2.4.2. Applications: Support of heavy equipment where preventing noise transmission to adjacent spaces is critical. Inertia bases are used to support mechanical equipment, reduce equipment vibration, provide for attachment of vibration isolators, prevent differential movement between driving and driven members, reduce rocking by lowering equipment center of gravity, reduce motion of equipment during start-up and shut-down, act to reduce reaction movement due to operating loads on equipment, and act as a noise barrier.
- 2.2.4.3. *Typical uses for inertia base frames, with poured concrete and supported by noise and vibration isolators, include use with open-type centrifugal chillers, reciprocating air and refrigeration compressors, chillers, and heat pumps, close-coupled and base-mounted pumps, centrifugal fans, internal combustion engines, and similar types of equipment.*
- 2.2.4.4. Standard of Acceptance: Kinetics Noise Control model CIB-L

2.2.5. Vibration Isolator Rails

- 2.2.5.1. Spring components shall be 1"/25 mm for air handling equipment/condensing units and 2"/50 mm deflection for cooling towers/chillers, free-standing, un-

housed, laterally stable steel springs. Springs shall have a lateral stiffness greater than 1.0 times the rated vertical stiffness and shall be designed for 50% overload to solid.

- 2.2.5.2. Springs shall be color coded to indicate load capacity.
- 2.2.5.3. Rails shall provide continuous support for the rooftop equipment and shall be designed to provide isolation against casing-radiated vibration in the rooftop equipment housing and structure borne vibration from rotating and mechanical equipment in the rooftop package.
- 2.2.5.4. Rail assembly shall consist of extruded aluminum top and bottom members connected by spring isolators and a continuous air- and water-tight seal. The seal shall be a beaded elastomeric material retained in a keyway along the top extrusion. The weather strip shall be sealed along the bottom with an aluminum fascia strip.
- 2.2.5.5. Rail assemblies shall incorporate means for attachment to the building and the supported equipment and shall incorporate additional stiffening members if necessary to assure stability.
- 2.2.5.6. Vibration isolators shall be selected by the manufacturer for each specific application to comply with deflection requirements as shown on the Vibration Isolation Schedule or as indicated on the project documents.
- 2.2.5.7. *Application: designed and engineered to isolate packaged roof mounted equipment from the roof structure. Typical applications: cooling tower, condensing units, roof mounted air handling equipment and similar*
- 2.2.5.8. Where specified, the vibration isolation rails shall have a positive elastomeric air and weather seal permitting the inside of the unit to be used as a return air plenum. The KSR mates with the inside of the manufacturers' curb eliminating any internal interference.
- 2.2.5.9. Standard of Acceptance: Kinetics Noise Control Model KSR

2.3. PIPING CONNECTIONS

2.3.1. Flexible Piping Connectors

- 2.3.1.1. Flexible Braided Hose Connectors – HVAC Systems
 - 2.3.1.1.1. Type 321 Stainless Steel Hose with type 304 Stainless Steel Outer Braid and 150# Carbon Steel Flat Faced Drilled Bolting Flanges
 - 2.3.1.1.2. Length: 229 mm (9") to 356" (14") depending on diameter. max. lateral offset: 10 mm (0.125")
 - 2.3.1.1.3. Application: piping connected to rotating equipment to reduce the transmission of noise and vibration, and to eliminate stresses in piping systems due to misalignment and thermal movement of the piping, where fluid temperature may exceed 90°C.
 - 2.3.1.1.4. Standard of Acceptance: Kinetics Noise Control model BFMC-FFF

2.3.1.2. Refrigerant Piping Flexible Hose Connectors

- 2.3.1.2.1. Bronze flexible bellows with bronze braided outer cover and shall have bronze female copper sweat ends.
- 2.3.1.2.2. Standards of Acceptance: Kinetics Noise Control model BFMC-CFE

2.3.2. Twin Sphere Neoprene Connector

- 2.3.2.1. Made of molded EPDM reinforced with nylon tire cord and shall have mild steel floating flanges. Use control rods to limit deflections and movements to within the prescribed values indicated by the manufacturer.
- 2.3.2.2. Axial compression: 50 mm (2"). Axial elongation: 30 mm (1.25"). Transverse movement: 40 mm (1.5")
- 2.3.2.3. Application: piping connected to rotating equipment piping connected to rotating equipment to reduce the transmission of noise and vibration, and to eliminate stresses in piping systems due to misalignment and thermal movement of the piping, where fluid temperatures remain in the -10 deg. C to 90 deg. C (14 deg. F to 190 deg. F).
- 2.3.2.4. Standard of Acceptance: Kinetics Noise Control model FTC

2.4. DUCTWORK CONNECTIONS

2.4.1. Ductwork Flexible Connector

- 2.4.1.1. Fully welded match drilled carbon steel flanges equipped with backing bars fastened in place with zinc plated hardware and EPDM flex membrane material. Acoustically rated design shall be used where called for on the design documentation, with an absorptive acoustic fill and EPDM outer barrier.
- 2.4.1.2. EPDM Flexible material: 1/8" thick layered EPDM flex membrane with internal nylon scrim for superior tear strength. Resistant to ozone and UV exposure and cold cracking (suitable for outdoor use).
- 2.4.1.3. Aerodynamic protective metal flow liner for air streams in excess of 6,000 cfm.
- 2.4.1.4. Construction: flange to flange distance: 200 mm (8") static mode. Lateral and axial movement: +/- 12.5 mm (1/2 inch). Operating temperature: up to 100 deg. C (212 deg. F)
- 2.4.1.5. Application: between fans (intake and discharge) and ductwork.
- 2.4.1.6. *Exception: not required for air handling units where fans are internally isolated*
- 2.4.1.7. Standard of Acceptance: Kinetics Noise Control model Kineflex

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. Statically and dynamically balance all pumps, fans, compressors and drivers. Align shafts of pumps, fans, and drivers to limit noise and vibration to specified values. Level and anchor equipment as necessary to achieve and maintain alignment.
- 3.1.2. All equipment mounted on vibration isolators springs shall have a minimum operating clearance of 2 inches between the bottom of the equipment or inertia base (and height saving bracket) and the concrete housekeeping pad (or bolt heads) beneath the equipment.
- 3.1.3. Check the clearance to ensure that no scraps have been left to short circuit the vibration isolators.
- 3.1.4. Provide a minimum of 4 inches between isolated equipment and the walls, ceiling, floors, columns and any other equipment not installed on vibration isolators.
- 3.1.5. Piping, ductwork, conduit or mechanical equipment shall not be hung from or supported on other equipment, pipes, or ductwork installed on vibration isolators.
- 3.1.6. Equipment connected to water or other fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping. Equipment should be blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims.
- 3.1.7. All mechanical equipment not specifically identified in this specification that contains rotating or vibration elements shall be installed on neoprene isolators as appropriate. Provide supporting steel structure between isolators and equipment if isolator does not readily connect to equipment.

3.2. FLOOR MOUNTED PUMPS

- 3.2.1. Neoprene Isolation pads with or without inertia concrete pads – as specified or shown on the drawings.

3.3. FLOOR MOUNTED BOILERS

- 3.3.1. Neoprene isolation pads – select to suit equipment weight.

3.4. FLOOR MOUNTED FANS AND AIR HANDLING EQUIPMENT

- 3.4.1. Neoprene isolation pads (less than 10,000 cfm), restrained springs (above 10,000 cfm) with or without inertia concrete pads, as specified or shown on the drawings. Secure springs to equipment and pads.

3.5. FLOOR OR ROOF MOUNTED CHILLERS/COOLING TOWERS

- 3.5.1. Restrained springs or vibration isolation rails, number and location of springs coordinated with the equipment manufacturer and selected to suit equipment weight. For indoor equipment, use inertia isolation pads where shown on the drawings. Secure springs or rails to equipment and support structure (outdoors) or pads (indoors).

3.6. PIPING ISOLATION

- 3.6.1. Use flexible hoses or neoprene vibration isolators at all connections between piping and equipment containing rotating parts (pumps, air handlers, chillers, cooling towers, etc). Applicable to refrigerant piping as well. Do not use neoprene isolators outdoors or where fluid temperatures temperature not suitable.
- 3.6.2. Use restrained spring isolators for the first three piping supports upstream and downstream of each pump.

3.7. CEILING SUSPENDED EQUIPMENT

- 3.7.1. Restrained spring isolators or neoprene isolation pads, as indicated on the drawings

3.8. AIR COOLED CONDENSING UNITS

- 3.8.1. Neoprene pad or elastomeric mounts secured to the support structure and equipment base rails (less than 50 ton capacity). Select based on equipment weight.
- 3.8.2. Restrained springs or vibration isolator rails secured to the support structure and equipment base rails (over 50 ton capacity). Select based on equipment weight.

3.9. AIR COOLED CONDENSING UNITS

- 3.9.1. Neoprene pad or elastomeric mounts secured to the support structure and equipment base rails

3.10. ROOFTOP AIR HANDLING UNITS AND UTILITY TYPE EXHAUST FANS

- 3.10.1. Vibration isolation rails (where specified)

3.11. DUCT CONNECTORS

- 3.11.1. At all connections between fans and ductwork, where not provided by the manufacturer.
- 3.11.2. Exception: kitchen grease exhaust ductwork connection to exhaust fan.

3.12. ELECTRICAL CONNECTIONS

- 3.12.1. All wiring connections to mechanical equipment on vibration isolators (either spring or neoprene type) shall be made with a minimum 36 inch long flexible liquid-tight conduit in a 360° loop. Coordinate wiring connections with the electrical sub-trade.

3.13. INSPECTION

- 3.13.1. Supplier shall inspect and approve the installation of the vibration isolators and shall submit a report to the Client which verifies that all of the isolation equipment has been properly installed and that the installation is in full conformance with the specification. The report shall record the vibration isolator identification and model or type.
- 3.13.2. For isolators containing steel springs the report shall also record the size and uncompressed height, design static deflection and measured static deflection of the isolators provided.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. RELATED DOCUMENTS	2
1.2. SUMMARY	2
1.3. SUBMITTAL	2
PART 2 - PRODUCTS	2
2.1. STANDARDS OF ACCEPTANCE	2
2.2. EQUIPMENT LABELS	2
2.3. WARNING SIGNS AND LABELS	3
2.4. PIPE LABELS	4
2.5. VALVE TAGS	5
2.6. DUCT LABELS	5
2.7. OTHER SPECIALIZED LABELING AND REQUIREMENTS	6
2.8. STENCILING	6
PART 3 - EXECUTION	6
3.1. PREPARATION	6
3.2. EQUIPMENT LABEL INSTALLATION	6
3.3. VALVE TAG INSTALLATION AND DOCUMENTATION	7
3.4. DUCT LABEL INSTALLATION	7

PART 1 - GENERAL**1.1. RELATED DOCUMENTS**

1.1.1. Drawings and general provisions of the Contract apply to this Section.

1.1.1.1. Section: 23 21 13 Hydronic Piping.

1.2. SUMMARY

1.2.1. Section Includes:

1.2.1.1. Equipment labels.

1.2.1.2. Warning signs and labels.

1.2.1.3. Pipe labels.

1.2.1.4. Valve tags.

1.2.1.5. Duct labels.

1.2.2. For BAS identification, also refer to requirements of Section: 23 09 00 Instrumentation and Control for HVAC.

1.3. SUBMITTAL

1.3.1. Product Data: For each type of product indicated.

PART 2 - PRODUCTS**2.1. STANDARDS OF ACCEPTANCE**

2.1.1.1. Brady, Kolbi, or Panduit.

2.2. EQUIPMENT LABELS

2.2.1.1. Metal Labels for Equipment:

2.2.1.1.1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having pre-drilled or stamped holes for attachment hardware.

2.2.1.1.2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

2.2.1.1.3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

2.2.2. Fasteners: Stainless-steel rivets or self-tapping screws.

2.2.3. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.2.4. Plastic Labels for Equipment:

- 2.2.4.1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- 2.2.4.2. Letter Color: White.
- 2.2.4.3. Background Color: Black.
- 2.2.4.4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- 2.2.4.5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- 2.2.4.6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

2.2.5. Fasteners: Stainless-steel rivets or self-tapping screws.

2.2.6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.2.7. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

2.2.8. Label is to also indicate area and type of service being provided.

2.2.8.1. For Example AHU - 3 - floors 1-4

2.2.8.2. P3 HW Hot Water Pump - building perimeter

2.2.9. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3. WARNING SIGNS AND LABELS

2.3.1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2.3.2. Letter Color: White.

2.3.3. Background Color: Red.

2.3.4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

2.3.5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

- 2.3.6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- 2.3.7. Fasteners: Stainless-steel rivets or self-tapping screws.
- 2.3.8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- 2.3.9. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4. PIPE LABELS

- 2.4.1. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, showing flow direction, and area served (i.e. perimeter heating hot water).
- 2.4.2. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- 2.4.3. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
- 2.4.4. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction, and visible all around pipe.
- 2.4.5. Lettering Size: At least 1-1/2 inches high.
- 2.4.6. All piping, except that piping which is within inaccessible chases, shall be identified.
- 2.4.7. Each marker background shall be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems" (ASME A13.1-1981).
- 2.4.8. Set mark snap-around markers shall be used for overall diameters up to 6" and strap around markers shall be used above 6" overall diameters.
- 2.4.9. Markers shall be located:
 - 2.4.9.1. Adjacent to each valve
 - 2.4.9.2. At each branch
 - 2.4.9.3. At each cap for future
 - 2.4.9.4. At each riser takeoff,
 - 2.4.9.5. At each pipe passage through wall (each side)

- 2.4.9.6. At each pipe passage at 20' – 0" intervals maximum.
- 2.4.9.7. At each piece of equipment.
- 2.4.9.8. At all access doors.
- 2.4.9.9. A minimum of one (1) marker shall be provided at each room.

2.5. VALVE TAGS

- 2.5.1. Valve tags shall be according to project valve specification section(s). Unless required differently in project valve specification section(s), valve tags to be minimum 1.5" round brass, attached with metallic chains.

2.6. DUCT LABELS

- 2.6.1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2.6.1.1. Letter Color: White.
 - 2.6.1.2. Background Color: Red.
 - 2.6.1.3. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 2.6.1.4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 2.6.1.5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- 2.6.2. Fasteners: Stainless-steel rivets or self-tapping screws.
- 2.6.3. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- 2.6.4. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
- 2.6.5. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
- 2.6.6. Lettering Size: At least 1-1/2 inches high.
- 2.6.7. Markers shall be located:
 - 2.6.7.1. Adjacent to each air handling equipment
 - 2.6.7.2. At each branch
 - 2.6.7.3. At each cap for future
 - 2.6.7.4. At each riser takeoff,
 - 2.6.7.5. At each duct passage through wall (each side)

- 2.6.7.6. On each duct straight run at 20' – 0" intervals maximum.
- 2.6.7.7. At all access doors.
- 2.6.7.8. A minimum of one (1) marker shall be provided at each room.

2.7. OTHER SPECIALIZED LABELING AND REQUIREMENTS

- 2.7.1. Fire damper access panels shall be permanently identified on the exterior by labels not less than 2" in height reading "FIRE DAMPER".
- 2.7.2. Smoke damper access panels shall be permanently identified on the exterior by labels not less than 2" in height reading "SMOKE DAMPER".
- 2.7.3. Combination fire/smoke damper access panels shall be permanently identified on the exterior by labels not less than 2" in height reading "RESETTABLE FIRE/SMOKE DAMPER". Mark the other access panels "FIRE/SMOKE DAMPER."
- 2.7.4. Items listed in items 1-3 above, will also be listed on a full size, laminated print and left in the main mechanical room as indicated above.
- 2.7.5. Duct static pressure sensors shall be permanently identified on the exterior by labels not less than 2" in height reading "STATIC PRESSURE SENSOR".
- 2.7.6. Humidity sensors in ductwork shall be permanently identified on the exterior by labels not less than 2" in height reading "HUMIDITY SENSOR".
- 2.7.7. Abbreviations: No abbreviations to be used.
- 2.7.8. All smoke and fire damper locations are to be posted as a pdf on the DDC system per fan system. This information is also to be located in the fire command center for the building. Coordinate with other trades to make sure this happens, and support as required via that coordination.

2.8. STENCILING

- 2.8.1. Not allowed.

PART 3 - EXECUTION

3.1. PREPARATION

- 3.1.1. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2. EQUIPMENT LABEL INSTALLATION

- 3.2.1. Install or permanently fasten labels on each major item of mechanical equipment.

3.2.2. Locate equipment labels where accessible and visible.

3.3. VALVE TAG INSTALLATION AND DOCUMENTATION

3.3.1. Tag valves according to project valve specification section(s), and provide typed list (loose and framed under glass) per same specification section(s).

3.3.2. A valve tag schedule is to be mounted in each mechanical room and on every floor (for that respective floor) in a location to be determined by the Consultant

3.3.3. Each valve tag schedule will have an associated architectural print showing each valve location.

3.3.4. At project completion two additional hard copies are to be provided in addition to an electronic copy.

3.3.5. Two copies of the mechanical piping flow diagram will be supplied. All prints that are supplied that are located in mechanical rooms are to be laminated.

3.3.6. Pipe tags that are the first isolation for a utility in a mechanical room or building need to have indicated where the next upstream valve is located and the associated valve number indicated on the valve tag.

3.3.7. This is applicable for all utility isolation valves for each mechanical room space.

3.4. DUCT LABEL INSTALLATION

3.4.1. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

3.4.1.1. Blue: For cold-air supply ducts.

3.4.1.2. Yellow: For hot-air supply ducts.

3.4.1.3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

3.4.1.4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

3.4.2. Locate labels at maximum intervals of 10 feet, at every change in direction, and within 3' of wall and floor penetrations on both sides of same.

3.4.3. Along with all other ducting on the job, label toxic exhaust.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. QUALITY ASSURANCE	2
1.4. SUBMITTALS	4
1.5. APPLICABLE PUBLICATIONS	5
PART 2 - PRODUCTS	5
2.1. PLUGS	5
2.2. INSULATION REPAIR MATERIAL	5
PART 3 - EXECUTION	6
3.1. GENERAL	6
3.2. DESIGN REVIEW REPORT	6
3.3. SYSTEMS INSPECTION REPORT	6
3.4. SYSTEM READINESS REPORT	6
3.5. TAB REPORTS	7
3.6. TAB PROCEDURES	7
3.7. LOCATION OF MEASUREMENTS AND MEASURED PARAMETERS	8
3.8. MARKING OF SETTINGS	8
3.9. IDENTIFICATION OF TEST PORTS	9

PART 1 - GENERAL**1.1. DESCRIPTION**

1.1.1. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

- 1.1.1.1. Planning systematic TAB procedures.
- 1.1.1.2. Design Review Report.
- 1.1.1.3. Systems Inspection report.
- 1.1.1.4. Duct Air Leakage test report.
- 1.1.1.5. Systems Readiness Report.
- 1.1.1.6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
- 1.1.1.7. Recording and reporting results.

1.1.2. Definitions:

- 1.1.2.1. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
- 1.1.2.2. AABC: Associated Air Balance Council.
- 1.1.2.3. NEBB: National Environmental Balancing Bureau.

1.1.3. Hydronic Systems: Includes chilled water, condenser water, heating hot water and glycol water systems as applicable to the project.

1.1.4. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems, as applicable to the project.

1.1.5. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2. RELATED WORK

1.2.1. Section: 23 05 00 Common Work Results for HVAC.

1.2.2. Section: 23 21 13 Hydronic Piping.

1.3. QUALITY ASSURANCE

1.3.1. Qualifications:

- 1.3.1.1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.

- 1.3.1.2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Consultant and submit another TAB firm for approval.
- 1.3.2. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein.
- 1.3.3. TAB Specialist shall be identified by the General Contractor within 10 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Consultant. The responsibilities would specifically include:
 - 1.3.3.1. Shall directly supervise all TAB work.
 - 1.3.3.2. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
 - 1.3.3.3. Would follow all TAB work through its satisfactory completion.
 - 1.3.3.4. Shall provide final markings of settings of all HVAC adjustment devices.
 - 1.3.3.5. Permanently mark location of duct test ports.
- 1.3.4. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Consultant is to ensure that the Tab Technicians are qualified before work is performed. The lead technician shall be certified by AABC or NEBB
- 1.3.5. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- 1.3.6. Tab Criteria:
 - 1.3.6.1. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.
 - 1.3.6.2. Tolerances:

- 1.3.6.2.1. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): +/-5% of design values noted in the equipment schedules.
- 1.3.6.2.2. Air terminal units (maximum values): +/-5% of the design values noted on the equipment schedules.
- 1.3.6.2.3. Exhaust hoods/cabinets: 0% to +10% of the design values noted on the equipment schedules
- 1.3.6.2.4. Minimum outside air: 0% to +10% of the design values noted on the equipment schedules
- 1.3.6.2.5. Individual room air outlets and inlets, and air flow rates not mentioned above: +/-5% of the design values noted on the equipment schedules.
- 1.3.6.2.6. Heating hot water pumps and hot water coils: +/-5% of the design values noted on the equipment schedules.
- 1.3.6.2.7. Chilled water and condenser water pumps: 0% to +5% of the design values noted on the equipment schedules
- 1.3.6.2.8. Chilled water coils: 0% to +5% of the design values noted on the equipment schedules.
- 1.3.6.2.9. Heat output capacities: 0% to +10% of the design values noted on the equipment schedules
- 1.3.6.2.10. Cooling output capacities: +/-5% of the design values noted on the equipment schedules
- 1.3.7. Typical TAB procedures and results shall be demonstrated to the Consultant for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the Consultant) and one hydronic system (pumps and three coils) as follows:
 - 1.3.7.1. When field TAB work begins.
 - 1.3.7.2. During each partial final inspection and the final inspection for the project if requested by the Board

1.4. SUBMITTALS

- 1.4.1. Submit in accordance with Section: 01 33 23 Shop Drawings, Product Data, and Samples.
- 1.4.2. Submit names and qualifications of TAB agency and TAB specialists within 10 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- 1.4.3. Submit Following for Review and Approval:
 - 1.4.3.1. Design Review Report within 10 days after the award of contract from the General Contractor.
 - 1.4.3.2. Systems inspection report on equipment and installation for conformance with design.

- 1.4.3.3. Duct Air Leakage Test Report.
- 1.4.3.4. Systems Readiness Report.
- 1.4.4. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
- 1.4.5. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- 1.4.6. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

1.5. APPLICABLE PUBLICATIONS

- 1.5.1. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.
 - 1.5.1.1. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
 - 1.5.1.2. 2007 HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control
 - 1.5.1.3. Associated Air Balance Council (AABC):
 - 1.5.1.3.1. AABC National Standards for Total System Balance
 - 1.5.1.3.2. National Environmental Balancing Bureau (NEBB):
 - 1.5.1.3.3. 7th Edition 2005 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems
 - 1.5.1.3.4. 2nd Edition 2006 Procedural Standards for the Measurement of Sound and Vibration
 - 1.5.1.3.5. 3rd Edition 2009 Procedural Standards for Whole Building Systems Commissioning of New Construction
 - 1.5.1.4. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1.5.1.4.1. 3rd Edition 2002 HVAC SYSTEMS Testing, Adjusting and Balancing

PART 2 - PRODUCTS

2.1. PLUGS

- 2.1.1. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2. INSULATION REPAIR MATERIAL

- 2.2.1. See Section: 23 07 00 HVAC Insulation.
- 2.2.2. Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.
- 3.1.2. *Coordinate all balancing work with the BAS vendor. Where balancing variable flow systems, fine tune the pressure differential sensor settings to ensure that all end users receive adequate water and air flows.*

3.2. DESIGN REVIEW REPORT

- 3.2.1. The TAB Specialist shall review the Contract Plans and specifications and advise the Consultant of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3. SYSTEMS INSPECTION REPORT

- 3.3.1. Inspect equipment and installation for conformance with design.
- 3.3.2. The inspection and report are to be done after piping and air distribution equipment is on site and piping/duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
- 3.3.3. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.4. SYSTEM READINESS REPORT

- 3.4.1. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated on drawings. Submit report of findings to Consultant.
- 3.4.2. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to Consultant in standard format and forms prepared and or approved by the Commissioning Agent, as applicable to the project.
- 3.4.3. Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Consultant.

3.5. TAB REPORTS

- 3.5.1. The TAB contractor shall provide raw data immediately in writing to the Consultant if there is a problem in achieving intended results before submitting a formal report.
- 3.5.2. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval at no additional cost to the Board.
- 3.5.3. Do not proceed with the remaining systems until intermediate reports are reviewed by the Consultant.

3.6. TAB PROCEDURES

- 3.6.1. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- 3.6.2. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.
- 3.6.3. For air handling systems, perform balancing work when the building envelope is substantially completed (windows and doors installed, ceilings completed, transfer grilles installed)
- 3.6.4. For air handling systems equipped with hydronic components, make air and hydronic balancing at the same time.
- 3.6.5. Air Balance and Equipment Test: Include air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, computer room AC units, and laboratory fume hoods and biological safety cabinets.
- 3.6.6. Artificially load air filters by partial blanking to produce air pressure drop of manufacturer's recommended pressure drop.
- 3.6.7. Adjust fan speeds to provide design air flow.
- 3.6.8. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
- 3.6.9. Variable air volume (VAV) systems:
 - 3.6.9.1. Not applicable to this project

3.6.10. Water Balance and Equipment Test: Include circulating pumps, convertors, heat exchangers, boilers, coils, coolers and condensers

3.6.10.1. Adjust flow rates for equipment.

3.6.10.2. Primary secondary (variable volume) systems: Balance systems at design water flow and then verify that variable flow controls function as designed.

3.6.10.3. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.

3.7. LOCATION OF MEASUREMENTS AND MEASURED PARAMETERS

3.7.1. Perform hydronic measurements at each:

3.7.1.1. Boiler

3.7.1.2. Coil

3.7.1.3. Heat Exchanger

3.7.1.4. Control Valve

3.7.1.5. Balancing Valve

3.7.2. Perform air measurements at each:

3.7.2.1. Fan/Air Handling System discharge

3.7.2.2. Exhaust fan

3.7.2.3. Coil

3.7.2.4. Fresh air/Exhaust damper

3.7.2.5. Terminal unit

3.7.2.6. Air distribution equipment

3.7.3. Measured parameters

3.7.3.1. Air flows

3.7.3.2. Hydronic flows

3.7.3.3. Temperatures entering/leaving coils (hydronic and air)

3.7.3.4. Pressure drops at each measured equipment/device (hydronic and air)

3.7.3.5. Electric Power drawn by electrical equipment

3.8. MARKING OF SETTINGS

3.8.1. Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Consultant.

3.9. IDENTIFICATION OF TEST PORTS

- 3.9.1. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. QUALITY ASSURANCE	2
1.4. SUBMITTALS	3
1.5. STORAGE AND HANDLING OF MATERIAL	3
1.6. APPLICABLE PUBLICATIONS	3
1.7. STANDARDS OF ACCEPTANCE	4
PART 2 - PRODUCTS	4
2.1. HVAC PIPING INSULATION.....	4
2.2. FITTINGS, FLANGE AND VALVE INSULATION – HOT AND COLD PIPING	7
2.3. EQUIPMENT INSULATION	7
PART 3 - EXECUTION	7
3.1. GENERAL REQUIREMENTS.....	7
3.2. INSULATION INSTALLATION.....	9
3.3. INSULATION JOINTS.....	9
3.4. FIELD-APPLIED JACKET APPLICATION	9

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. Field applied insulation for thermal efficiency and condensation control for HVAC piping, ductwork and equipment.
- 1.1.2. Re-insulation of HVAC piping, ductwork and equipment after asbestos abatement.
- 1.1.3. Definitions
 - 1.1.3.1. ASJ: All service jacket, white finish facing or jacket.
 - 1.1.3.2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
 - 1.1.3.3. Cold: Equipment or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
 - 1.1.3.4. Concealed: Piping above ceilings and in chases, interstitial space, and pipe chases.
 - 1.1.3.5. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
 - 1.1.3.6. Hot: Hot water equipment or piping handling media above 41 degrees C (105 degrees F).
 - 1.1.3.7. Thermal conductance: Heat flow rate through materials.
 - 1.1.3.8. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
 - 1.1.3.9. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). or the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.

1.2. RELATED WORK

- 1.2.1. Section: 23 05 00 Common Work Results for HVAC.
- 1.2.2. Section: 23 21 13 Hydronic Piping.

1.3. QUALITY ASSURANCE

- 1.3.1. Comply with OBC requirements for flame spread and smoke development rates.
- 1.3.2. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. For pipe, use insulation manufacturer's published heat flow tables. For

domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.

- 1.3.3. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.
- 1.3.4. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material

1.4. SUBMITTALS

- 1.4.1. Submit in accordance with Section: 01 33 23 Shop Drawings, Product Data, and Samples.
- 1.4.2. Shop Drawings:
 - 1.4.2.1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
 - 1.4.2.2. Insulation materials: Specify each type used and state surface burning characteristics.
 - 1.4.2.3. Insulation facings and jackets: Each type used.
 - 1.4.2.4. Insulation accessory materials: Each type used.
 - 1.4.2.5. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
 - 1.4.2.6. Make reference to applicable specification paragraph numbers for coordination.

1.5. STORAGE AND HANDLING OF MATERIAL

- 1.5.1. Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6. APPLICABLE PUBLICATIONS

- 1.6.1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- 1.6.2. National Fire Protection Association (NFPA):
 - 1.6.2.1. 101-09 Life Safety Code
 - 1.6.2.2. 251-06 Standard methods of Tests of Fire Endurance of Building Construction Materials

- 1.6.2.3. 255-06 Standard Method of tests of Surface Burning Characteristics of Building Materials

- 1.6.3. Underwriters Laboratories, Inc (UL):

- 1.6.3.1. 723 UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 08/03

- 1.6.4. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS):

- 1.6.4.1. SP58-2002 Pipe Hangers and Supports Materials, Design, and Manufacture

1.7. STANDARDS OF ACCEPTANCE

- 1.7.1. Owens/Corning, Knauf, Johns Mansville

PART 2 - PRODUCTS

2.1. HVAC PIPING INSULATION

- 2.1.1. Application (as applicable to the project)

- 2.1.1.1. All hot water heating/glycol
- 2.1.1.2. All chilled water/glycol
- 2.1.1.3. All steam piping
- 2.1.1.4. All condensate piping
- 2.1.1.5. All piping conveying water and located in spaces where the temperature can drop below freezing. Also refer to heat tracing specifications
- 2.1.1.6. All other piping conveying fluids warmer than 30°C or colder than 18°C

- 2.1.2. Mineral Fiber Or Fiber Glass

- 2.1.2.1. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), class 1, k = 0.037 (0.26) at 24 degrees C (75 deg. F), for use at temperatures from -20 deg. C (-4 deg.F) and up to 230 deg.C (450 deg. F)with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.
- 2.1.2.2. Thickness:
 - 2.1.2.2.1. Piping larger than 75mm (3"): 38 mm thickness
 - 2.1.2.2.2. Piping nominal 25mm-75mm (1-3"): 25 mm thickness
 - 2.1.2.2.3. Piping nominal 19mm (3/4") and less: 12 mm thickness
 - 2.1.2.2.4. Outdoor insulation (any size): increase insulation thickness by 12 mm (1/2")
- 2.1.2.3. At fittings and flanges (including water meter and body of roof drains), insulate with wrapped fiberglass insulation of same thickness as adjacent pipe, and cover with pre-molded PVC jackets. Seal edge of jacket with self-sealing vapor barrier tape.

2.1.3. Insulation Facings And Jackets

2.1.3.1. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets.

2.1.3.2. Facings and jackets

2.1.3.2.1. Concealed indoor areas:

- Shall be all service type (ASJ) in concealed spaces and PVC Vapor Retarder jacketing in all exposed areas, including mechanical rooms and service areas.
- All service Jacket (ASJ) shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- Standard of Acceptance: Zeston, Ceeco, Proto

2.1.3.2.2. Exposed indoor areas:

- Shall be heavy PVC fitting covers (0.75 mm thickness. Overlap PVC covers on pipe insulation jackets as least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

2.1.3.2.3. Indoor Fittings Jackets

- Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.
- Adhesive: Compatible with PVC jacket, and recommended by insulation material manufacturer.
- Standard of Acceptance: Zeston, Ceeco, Proto

2.1.3.2.4. Aluminum Jackets – Outdoor Piping and Fittings

- Aluminum Jacket-Piping systems: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

- Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.
- Neither rivets, screws, staples nor any other fastener capable of penetrating the underlying vapor retarder shall be used to secure the aluminum jacketing.
- Standards of Acceptance: Childers-Lock-on and Pabco-Surfeit.

2.1.4. Pipe Covering Protection Saddles

- 2.1.4.1. Cold pipe support - indoors: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).
- 2.1.4.2. Warm or hot pipe supports - indoors: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m³ (3.0 pcf).
- 2.1.4.3. All piping – outdoors: Metallic shield shall be made of galvanized steel painted on both sides with a minimum two coats of aluminum paint. 180 degree for clevises and roller type hangers and 360 degree for clamp type hangers and supports. Shield and insert length and gauge shall be 400 mm (16") long and min. 2.75 mm (12ga) thickness.

2.1.5. Adhesive, Mastic, Cement

- 2.1.5.1. Insulation manufacturers' published recommendations.

2.1.6. Mechanical Fasteners

- 2.1.6.1. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- 2.1.6.2. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.1.7. Flame And Smoke

- 2.1.7.1. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

2.2. **FITTINGS, FLANGE AND VALVE INSULATION – HOT AND COLD PIPING**

- 2.2.1. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place.
- 2.2.2. For hot piping finish with a smoothing coat of finishing cement.
- 2.2.3. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
- 2.2.4. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
- 2.2.5. Nominal thickness: same as piping of same size.

2.3. **EQUIPMENT INSULATION**

- 2.3.1. Applications: all heat exchangers, chilled water pumps, chilled water expansion tanks, chiller headers or evaporator vessels
- 2.3.2. Flexible Elastomeric Cellular Thermal insulation, ASTM C177, C518, $k = 0.039$ (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

PART 3 - EXECUTION

3.1. **GENERAL REQUIREMENTS**

- 3.1.1. Required pressure tests of piping and ductwork joints and connections shall be completed and the work approved by the Consultant for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- 3.1.2. Except for specific exceptions, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.
- 3.1.3. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers

and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

- 3.1.4. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- 3.1.5. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- 3.1.6. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- 3.1.7. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- 3.1.8. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights.
- 3.1.9. Hot piping work not to be insulated:
 - 3.1.9.1. Factory pre-insulated components.
 - 3.1.9.2. Over equipment nameplates.
 - 3.1.9.3. Vibration control devices
 - 3.1.9.4. Air chambers, unions, strainers, check valves, flow regulators.
 - 3.1.9.5. Pot feeders, filtration cartridges
- 3.1.10. Firestop Pipe insulation:
 - 3.1.10.1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed.
 - 3.1.10.2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
 - 3.1.10.2.1. Pipe risers through floors
 - 3.1.10.2.2. Pipe chase walls and floors
 - 3.1.10.2.3. Smoke partitions

3.1.10.2.4. Fire partitions

3.1.10.2.5. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (0.75) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide where indicated on the drawings

3.1.11. Provide vapor barrier jackets over insulation as follows:

3.1.11.1. All piping and ductwork exposed to outdoor weather.

3.1.11.2. All interior piping and ductwork conveying fluids exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.

3.1.12. Provide metal jackets over insulation as follows:

3.1.12.1. All HVAC piping and ductwork exposed to outdoor weather.

3.2. INSULATION INSTALLATION

3.2.1. Molded Mineral Fiber Pipe and Tubing Covering:

3.2.1.1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.

3.3. INSULATION JOINTS

3.3.1. All insulation joints should be sealed with pressure-sensitive joint sealing tape to match the insulation facing. Rub hard with a plastic sealing tool to affect a tight bond.

3.3.2. Recommended practice: 3" (76mm) wide tape on flat surfaces or where edges are ship-lapped and stapled. Use 5" (102mm) wide tape in lieu of ship-lapping.

3.3.3. All sheet metal joints must be sealed prior to insulating.

3.4. FIELD-APPLIED JACKET APPLICATION

3.4.1. Apply PVC jacket on piping insulation where indicated, with 1 inch (25 mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

3.4.2. Apply aluminum jacket where indicated (piping and ductwork) and on all piping/ductwork located outdoors, with 2-inch (50 mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof

sealant recommended by insulation manufacturer. Secure jacket with stainless-steel band 12 inches (300 mm) o.c. and at end joints. Provide vapor-barrier jackets. Aluminum jackets shall have seams located below the horizontal plane of the horizontal piping route. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and cover with aluminum jackets.

Table of Contents

PART 1 - GENERAL	3
1.1. GENERAL	3
1.2. APPROVED CONTROL SYSTEMS	4
1.3. SCOPE OF WORK	4
1.4. QUALITY ASSURANCE	5
1.5. CODES AND STANDARDS	5
1.6. APPROVED CONTROL SYSTEM MANUFACTURERS	5
1.7. EQUIPMENT INSTALLED BY OTHERS (WHERE APPLICABLE TO PROJECT)	5
1.8. SUBMITTALS	6
1.9. PROJECT RECORD DOCUMENTS	8
1.10. WARRANTY	9
1.11. CLIENT OWNERSHIP OF PROPRIETARY MATERIAL	10
1.12. FACILITIES WITH EXISTING BUILDING AUTOMATION SYSTEM	10
1.13. CRITICAL ALARM CONTROL SEQUENCES	11
PART 2 - PRODUCTS	11
2.1. CONTROLLERS	11
2.2. COMMUNICATION	12
2.3. CONNECTION TO THE CLIENT SERVER	13
2.4. LOCAL SERVICE PORTS	13
2.5. COMMUNICATION	14
2.6. INPUT AND OUTPUT INTERFACE	15
2.7. POWER SUPPLIES AND LINE FILTERING	16
2.8. AUXILIARY CONTROL DEVICES	17
2.9. FAIL STATE POSITION OF OUTPUTS	26
2.10. LAN CABLING	26
2.11. WIRING AND RACEWAYS	27
PART 3 - EXECUTION	28
3.1. EXAMINATION	28
3.2. PROTECTION	28
3.3. COORDINATION	28

3.4.	GENERAL WORKMANSHIP	29
3.5.	FIELD QUALITY CONTROL	29
3.6.	EXISTING EQUIPMENT	29
3.7.	WIRING	30
3.8.	COMMUNICATION WIRING	32
3.9.	FIBER OPTIC CABLE	33
3.10.	INSTALLATION OF SENSORS	33
3.11.	FLOW SWITCH INSTALLATION	34
3.12.	ACTUATORS	34
3.13.	WARNING LABELS.....	35
3.14.	IDENTIFICATION OF HARDWARE AND WIRING	35
3.15.	PROGRAMMING	36
3.16.	SEQUENCES OF OPERATION	36
3.17.	EQUIPMENT ENCLOSURES AND LOCATIONS.....	37
3.18.	IDENTIFICATION AND LABELING OF CONTROL EQUIPMENT.....	37
3.19.	SYSTEM HARDWARE COMMISSIONING	39
3.20.	SUBSTANTIAL COMPLETION INSPECTION	41
3.21.	CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE.....	41
3.22.	CLEANING	42
3.23.	TRAINING	42

PART 1 - GENERAL**1.1. GENERAL**

- 1.1.1. This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section: 23 05 00 Common Work Results for HVAC.
- 1.1.2. The building is currently equipped with a BAS manufactured by Johnson Controls and installed by Yorklands Controls. The scope of work includes:
 - 1.1.2.1. Provide all required work and devices to connect the new equipment to the existing BAS.
 - 1.1.2.2. The new equipment shall be controlled based on the existing sequence of operation.
- 1.1.3. The Building Automation System (BAS) shall be capable of integrating multiple building functions, including equipment supervision and control, alarm management, energy management, and trend data collection. The BAS shall be the latest generation system available from the installation contractor that has been previously reviewed and accepted by the Client.
- 1.1.4. Perform an in-depth review of all existing control components associated with the work scope (e.g. controllers, control valves, control dampers, linkages, actuators, pipe and duct sensors, flow switches, etc.).
- 1.1.5. Immediately report any defective or inoperative components to the Consultant.
- 1.1.6. Co-ordinate and supervise the work of all sub-contractors required to complete the scope of work as specified in the contract documents.
- 1.1.7. The Controls Contractor and all sub-contractors shall employ only certified trades persons to carry out all applicable work.
- 1.1.8. Provide all necessary control wiring and hardware to complete the entire project, including but not limited to, wiring, fittings, connectors, conduits, hangers/supports, box covers, and all other accessories required to ensure complete, safe and fully operational systems.
- 1.1.9. The BAS at minimum, shall incorporate the following integrated features, functions, and services:
 - 1.1.9.1. Operator information, alarm management and control function.
 - 1.1.9.2. As-built drawings in a separate PDF file, to be retrievable by the Operator at any given time using the BAS interface.

- 1.1.9.3. Control access
- 1.1.9.4. Information management, including monitoring, transmission, archiving, retrieval and reporting functions
- 1.1.9.5. Diagnostic monitoring and reporting of BAS functions
- 1.1.9.6. Offsite monitoring and management access
- 1.1.9.7. Energy Management

1.2. APPROVED CONTROL SYSTEMS

- 1.1.1. Johnson Controls
- 1.1.2. Yorkland Controls

1.3. SCOPE OF WORK

1.3.1. The general outline of the scope of work includes but is not limited to the following:

- 1.3.1.1. Arrange for Electrical Authority inspection of all electrical work done by the Control Sub- Contractor. Submit the Certificate of Inspection and Product Approval Certificate with the as built documentation.
- 1.3.1.2. Provide new wiring.
- 1.3.1.3. Update software and graphical interface as required.
- 1.3.1.4. All line and low voltage wiring shall be run in EMT metal conduit.
- 1.3.1.5. Control wiring installed in exposed areas (common areas, mechanical rooms, outdoors) shall be run in IMC rigid metal conduit
- 1.3.1.6. Control wiring installed in the ceiling space shall be plenum rated and does not require rigid conduit. Any controls wiring in ceiling spaces is to be run in a cable management tray, and transitions from the tray shall neatly follow the building structure and any wall penetrations must be sleeved in conduit with nylon bushings.
- 1.3.1.7. Include all wiring, conduit, piping, installation, materials, supervision and labor including calibration, commissioning software programming and data base generation, and additional work necessary to provide a complete and fully operating system to the approval of the Consultant.
- 1.3.1.8. Controls sub-contractor shall coordinate with the electrical sub-contractor for the location of breakers and junction boxes from which power to the control's equipment will be provided. The over-all responsibility for providing and coordinating power supply to the controls equipment rests with the mechanical contractor in his capacity as general contractor.
- 1.3.1.9. The BAS shall be completed in all details not necessarily defined or shown on the drawings but as may be reasonably inferred as necessary to complete each system and provide operating service in an acceptable manner.
- 1.3.1.10. Upon completion of the installation, all control equipment supplied under this control shall be adjusted to place the system in complete operating condition

subject to the Owner's approval. All adjustments shall be made in co-ordination with the TAB sub-contractor responsible for balancing the air and water systems where required.

- 1.3.1.11. For variable flow systems (air or hydronic), coordinate the final settings of VFDs and pressure differential setpoints with the TAB contractor, to achieve the design flows noted in the equipment schedules.
- 1.3.1.12. When removing existing equipment, it is the responsibility of the contractor to ensure the integrity of the BAS communication line that must remain intact to ensure the proper function of the remainder of the school BAS system.

1.4. QUALITY ASSURANCE

- 1.4.1. Base bid basis of design products referenced under this Section establish the minimum acceptable standards of product quality, features and performance.
- 1.4.2. Work of this Section shall be provided by a recognized contractor regularly employed in the installation and wiring of BAS and temperature control system and equipment. The Client will provide a list of acceptable Contractors to bid the work (see Clients list of Pre-Qualified contractors).

1.5. CODES AND STANDARDS

- 1.5.1. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
 - 1.5.1.1. National Electric Code (NEC)
 - 1.5.1.2. International Building Code (IBC)
 - 1.5.1.2.1. Section 719 Ducts and Air Transfer Openings
 - 1.5.1.2.2. Section 907 Fire Alarm and Detection Systems
 - 1.5.1.2.3. Section 909 Smoke Control Systems
 - 1.5.1.3. Division 23 Mechanical
 - 1.5.1.4. International Mechanical Code (IMC)
 - 1.5.1.5. ANSI/ASHRAE 135-2004: Data Communication Protocol for Building Automation and Control Systems (BACNET)

1.6. APPROVED CONTROL SYSTEM MANUFACTURERS

- 1.6.1. Only approved building automation systems will be accepted.

1.7. EQUIPMENT INSTALLED BY OTHERS (WHERE APPLICABLE TO PROJECT)

- 1.7.1. As required, the following equipment shall be supplied as noted and installed by qualified sub trades as part of this contract:

1.7.2. Supply by Mechanical Contractor/Power wiring by Electrical Contractor/Controls wiring by Controls Contractor:

1.7.2.1. Variable Speed Drives, where not integral part of mechanical equipment

1.7.3. Supply Mechanical Contractor / Install – Mechanical Contractor

1.7.3.1. Automatic control dampers (not supplied with packaged equipment)

1.7.4. Supply Mech. Contractor/ install Control Contractor / wired by Control Contractor (not supplied with packaged equipment)

1.7.4.1. Damper Actuators

1.7.5. Supply by Control Contractor / install by Mech. Contractor/ wired by Control Contractor

1.7.5.1. Automatic Controls Valves & Actuators

1.7.5.2. Space temperature sensors

1.7.6. Supply and wired by Control Contractor/ installed by Mechanical Contractor

1.7.6.1. Temperature Sensing Wells

1.7.7. Supply by Mech. Contractor/ installed by Mech. Contractor/ wired by Control, Contractor

1.7.7.1. Air and Hydronic Flow and Pressure sensors

1.7.8. The final completeness of all required components to make equipment operational as indicated on the sequences of operation including wiring, setting and adjustment remains as the final the responsibility of the mechanical contractor acting as the general contractor.

1.8. SUBMITTALS

1.8.1. Provide three copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished. Drawings should be 11" x 17" prints.

1.8.2. Provide submittals within 6 weeks of contract award.

1.8.3. Begin no work until submittals have been approved for conformity with design intent.

1.8.4. Provide drawings using AutoCAD 2007 (or newer) in following formats: original, pdf and print.

1.8.5. Submittal approval does not relieve Contractor of responsibility to supply sufficient materials to complete work.

1.8.6. Provide submittals on the following:

- 1.8.6.1. Product Submittals. Clearly indicate applicable data on manufacturer's cut sheets by highlighting or by other means. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work.
- 1.8.6.2. Network Architecture. Riser diagrams showing control network layout, connections to all network devices, communication protocols, network speeds and wire types. Include schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.
- 1.8.6.3. Schematics. Schematic diagram of each controlled system. Label all control points with point names.
- 1.8.6.4. Wiring diagrams including complete power system, interlocks, control and data communications.
- 1.8.6.5. Programming code listing for all controllers
- 1.8.6.6. Manufacturers' data/specification sheets and catalogue cuts for all material and equipment supplied.
- 1.8.6.7. Floor plan schematic diagrams indicating field sensor and controller locations.
- 1.8.6.8. Valve Schedule. Indicate system and device designation, product name, manufacturer, and model numbers (both valve and actuator), quantities, sizes, Cv (design and actual), pressure drop, close-off pressure, configuration, ports, and line sizes of each supplied valve and existing control valve.
- 1.8.6.9. Damper Schedule. Indicate system and device designation, product name, manufacturer, size, and model numbers (both damper and actuator) of each supplied damper/actuator and existing control damper/actuator.
- 1.8.6.10. Room and Equipment Schedules. Indicate controller type, address, model number, object names, setpoints, and room location.
- 1.8.6.11. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
- 1.8.6.12. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
 - 1.8.6.12.1. Direct digital controllers (controller panels)
 - 1.8.6.12.2. Transducers and transmitters
 - 1.8.6.12.3. Sensors (include accuracy data)
 - 1.8.6.12.4. Actuators
 - 1.8.6.12.5. Valves
 - 1.8.6.12.6. Dampers
 - 1.8.6.12.7. Relays and switches
 - 1.8.6.12.8. Control panels
 - 1.8.6.12.9. Power supplies

1.8.6.12.10. Batteries

1.8.6.12.11. Operator interface equipment

1.8.6.12.12. Wiring

1.8.6.13. Complete description of control system operation including sequences of operation and points-lists for each control system. Include and reference schematic diagram of controlled system. List I/O points and software points specified in this section. Indicate alarmed and trended points.

1.8.6.14. Wiring diagrams and layouts for each control panel. Show termination numbers.

1.8.6.15. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.

1.8.6.16. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.

1.8.7. Schedules

1.8.7.1. Construction Schedule of work provided within one month of contract award, indicating:

1.8.7.1.1. Intended sequence of work items

1.8.7.1.2. Start date of each work item

1.8.7.1.3. Duration of each work item

1.8.7.1.4. Planned delivery dates for ordered material and equipment and expected lead times.

1.8.7.1.5. Milestones indicating possible restraints on work by other trades or situations.

1.8.8. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.

1.9. PROJECT RECORD DOCUMENTS

1.9.1. Submit three copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:

1.9.1.1. As-built versions of submittal shop drawings should be 11" x 17" prints. Provide drawings using AutoCAD 2007 (or newer) in following formats: original, pdf and print.

1.9.1.2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of this section (Control System Demonstration and Acceptance).

1.9.1.3. An Information sheet that contains:

1.9.1.3.1. School name and address

- 1.9.1.3.2. A brief description of the control details. i.e. total # of points, list of equipment controls and which panels they are connected to.
- 1.9.1.3.3. Panel's information i.e. part numbers for panels used and their serial numbers and revision # (if applicable)
- 1.9.1.3.4. Software version
- 1.9.1.3.5. Modem telephone number
- 1.9.1.3.6. Warranty start date and duration
- 1.9.1.3.7. BAS contractor Name, address, and Phone number
- 1.9.1.4. Detailed sequence of operation for each controlled system.
- 1.9.1.5. Control schematics for each system. Including a System Architecture indicating the type and model number for all BAS components, the proposed interconnection and location of all panels, network connection and key peripheral devices (workstations, modems, printers, repeaters, etc)
- 1.9.1.6. BAS Points List indicating the panel ID, panel location, hardware address, point acronym, point description, field device type, point type (i.e. AO/DO/AI/DI), end device fail position, end device manufacture and model number and wire tag ID.
- 1.9.1.7. Floor plan with the location of all field mounted control devices.
- 1.9.1.8. Programming code for all DDC controllers.
- 1.9.1.9. Wiring diagrams including complete power system, interlocks, control and data communications.
- 1.9.1.10. Manufacturers' data/specification sheets and catalogue cuts for all material and equipment supplied. This section shall include a summary sheet that indicates all BAS Device, Manufacturers', model number, and quantity of each used on this job.
- 1.9.1.11. Automatic control valves and dampers where required.
- 1.9.1.12. Commissioning list including the name of the commissioning agent of the BAS Contractor, his signature and the date of commissioning.
- 1.9.1.13. Licensed BAS workstation software.
- 1.9.1.14. BAS programming database stored on a USB memory stick.

1.10. WARRANTY

1.10.1. Warrant work as follows:

- 1.10.1.1. All labour and material (hardware and software) supplied under this contract shall be warranted free from defects for a period of two (2) years after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost to the Client. The Contractor shall respond to Client request for warranty service within one (1) business day.
- 1.10.1.2. The final completion and substantial performance date shall be the date of the project turnover meeting.

- 1.10.1.3. All work shall have a single warranty date, even when the Client has received beneficial use of part of the system in advance of the final completion date.
- 1.10.1.4. The contractor shall be responsible for correcting any deficiencies, errors or omissions in operating strategies, programming code, system functionality or parameters and operator workstation graphics during the warranty period.

1.11. CLIENT OWNERSHIP OF PROPRIETARY MATERIAL

- 1.11.1. Project-specific software and documentation shall become Client's property. This includes, but is not limited to:
 - 1.11.1.1. Record drawings / Documentation
 - 1.11.1.2. Database
 - 1.11.1.3. Application programming code (Two copies and two licenses of Engineering (Program) Tool)
 - 1.11.1.4. All documentation.

1.12. FACILITIES WITH EXISTING BUILDING AUTOMATION SYSTEM

- 1.12.1. Where a facility has an existing BAS that is to be replaced, modified or upgraded, the Controls Contractor shall be responsible for ensuring that the entire system (hardware, programming and system graphics) and all integral parts (new and re-used) are in conformance with all requirements of the specifications outlined herein.
- 1.12.2. Ensure complete interoperability and compatibility between new and existing DDC systems and components. Provide system firmware and/or hardware upgrades to existing DDC panels/modules where required to ensure a complete working system to the satisfaction of the Consultant.
- 1.12.3. Where an existing DDC panel is re-used, ensure that sufficient controller memory is present to provide for all specified control functions. Provide memory and/or panel upgrades where required to meet system memory requirements.
- 1.12.4. Provide new network communication wiring for interconnection between all DDC panels and interfaces.
- 1.12.5. Existing control wiring and conduits may be re-used only where they comply with the requirements of these specifications and where approved by the Consultant.
- 1.12.6. Ensure that all re-used DDC panels/modules are upgraded to the latest version of system firmware and system operating software.
- 1.12.7. Provide complete commissioning and verification of all re-used automation input/output points, end devices and components.

- 1.12.8. Provide new labeling for wiring, devices and equipment where existing labelling does not meet the requirements of these specifications.

1.13. CRITICAL ALARM CONTROL SEQUENCES

- 1.13.1. Critical alarms are displayed on the plant operator's PC. Critical alarms warn the building operators about critical control problems that require immediate attention.

- 1.13.2. Critical alarms shall be activated for the following reasons:

- 1.13.2.1. a boiler or air handler status has not responded to control by the FMS for more than 5 minutes
- 1.13.2.2. a VFD status has not responded to control by the FMS for more than 5 minutes
- 1.13.2.3. a heating pump or boiler pump status has not responded to control by the FMS for more than 10 minutes
- 1.13.2.4. a boiler flame ignition failed
- 1.13.2.5. a boiler low water cut off has shut the boiler
- 1.13.2.6. a boiler high limit temperature has shut the boiler
- 1.13.2.7. FMS low limit temperature controller has tripped
- 1.13.2.8. FMS supply fan and return fan status has been OFF
- 1.13.2.9. a space temperature has read below 16OC for more than 10 minutes
- 1.13.2.10. the radiation supply water temperature is more than 10OC below the supply water low limit for 1 hour during heating season (as determined by OAT)
- 1.13.2.11. return water temperature in the radiation and glycol loops has dropped 10OC below the low limit.

- 1.13.3. The remote alarm shall remain in effect until all of the critical alarm conditions are cleared.

- 1.13.4. The remote alarm shall be disabled when the outside air temperature is above 10OC.

PART 2 - PRODUCTS

2.1. CONTROLLERS

2.1.1. General.

- 2.1.1.1. Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance specified herein.
- 2.1.1.2. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L. Unless otherwise specified, hardwired actuators and sensors may be used in lieu of BACnet Smart Actuators and Smart Sensors.

2.1.2. BACNET.

- 2.1.2.1. Building Controllers (BCs): Each BC shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.
- 2.1.2.2. Advanced Application Controllers (AACs). Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.
- 2.1.2.3. Application Specific Controllers (ASCs). Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.
- 2.1.2.4. Smart Actuators (SAs). Each SA shall conform to BACnet Smart Actuator (B-SA) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-SA in the BACnet Testing Laboratories (BTL) Product Listing.
- 2.1.2.5. Smart Sensors (SSs). Each SS shall conform to BACnet Smart Sensor (B-SS) device profile as specified in ANSI/ASHRAE 135-2004, BACnet Annex L and shall be listed as a certified B-SS in the BACnet Testing Laboratories (BTL) Product Listing.

2.1.3. BACNET Communication.

- 2.1.3.1. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing.
- 2.1.3.2. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.
- 2.1.3.3. Each AAC shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
- 2.1.3.4. Each ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
- 2.1.3.5. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.
- 2.1.3.6. Each SS shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using ARCNET or MS/TP Data Link/Physical layer protocol.

2.2. COMMUNICATION

- 2.2.1. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135-2004, BACnet.
- 2.2.2. Install new wiring and network devices as required to provide a complete and workable control network.
- 2.2.3. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
- 2.2.4. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
- 2.2.5. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
- 2.2.6. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in this section. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
- 2.2.7. Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.
- 2.2.8. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

2.3. CONNECTION TO THE CLIENT SERVER

- 2.3.1. Advise the Client representative of the proposed location of the system router/gateway panel within the facility. The controls vendor shall provide a communication cable (RJ45) between the BAS Controller and the schools HUB under the Client supervision and comply with the Client standard and he shall connect the BAS to the Client server and WAN and confirm that network access to the BAS has been established.

2.4. LOCAL SERVICE PORTS

2.4.1. Every DDC panel shall be provided with a local network access port to connect to laptop computer. A user connected to the local access port shall have the same level of system access and functionality as being connected to the site workstation PC.

2.4.2. Where BAS points (4 or more) are located in a mechanical room that does not have a local BAS panel installed, a remote network access port shall be provided. The access port shall be installed in a hinged metal enclosure with key-lock set and Iamacoid ID label.

2.5. COMMUNICATION

2.5.1. Service Port

2.5.1.1. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.

2.5.2. Signal Management

2.5.2.1. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.

2.5.3. Data Sharing

2.5.3.1. Each BC and AAC shall share data as required with each networked BC and AAC.

2.5.4. Stand-Alone Operation

2.5.4.1. Each piece of equipment specified in this section Appendix A shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

2.5.5. Environment

2.5.5.1. Controller hardware shall be suitable for anticipated ambient conditions.

2.5.5.2. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).

2.5.5.3. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

2.5.6. Keypad

- 2.5.6.1. Provide a local keypad and display for each BC and AAC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not normally provide a keypad and display for each BC and AAC, provide the software and any interface cabling needed to use a laptop computer as a Portable Operator's Terminal for the system.

2.5.7. Real-Time Clock

- 2.5.7.1. Controllers that perform scheduling shall have a real-time clock

2.5.8. Serviceability

- 2.5.8.1. Controllers shall have diagnostic LEDs for power, communication, and processor.
- 2.5.8.2. Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.
- 2.5.8.3. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

2.5.9. Memory

- 2.5.9.1. Controller memory shall support operating system, database, and programming requirements.
- 2.5.9.2. Each BC and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.
- 2.5.9.3. Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.
- 2.5.9.4. Each controller shall have a min. 25% spare memory to allow for future expansion.
- 2.5.9.5. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

- 2.5.10. Transformer. ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2.6. INPUT AND OUTPUT INTERFACE

- 2.6.1. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

- 2.6.2. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.
- 2.6.3. Digital Inputs. Digital inputs shall monitor the on and off signal from a remote device. Digital inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Digital inputs shall sense dry contact closure without application of power external to the controller.
- 2.6.4. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.
- 2.6.5. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- 2.6.6. Digital Outputs. Digital outputs shall send an on-or-off signal for on and off control. Building Controller Digital outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.
- 2.6.7. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Analog outputs shall not drift more than 0.4% of range annually.
- 2.6.8. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.
- 2.6.9. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

2.7. POWER SUPPLIES AND LINE FILTERING

- 2.7.1. All electronic equipment shall be complete with all necessary devices to safeguard against voltage spikes, fluctuations, or any other power line anomalies, which might damage the equipment.
- 2.7.2. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

- 2.7.3. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
- 2.7.4. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
- 2.7.5. Line voltage units shall be UL recognized and CSA listed.
- 2.7.6. Power Line Filtering.
 - 2.7.6.1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:
 - 2.7.6.1.1. Dielectric strength of 1000 V minimum
 - 2.7.6.1.2. Response time of 10 nanoseconds or less
 - 2.7.6.1.3. Transverse mode noise attenuation of 65 dB or greater
 - 2.7.6.1.4. Common mode noise attenuation of 150 dB or greater at 40-100 Hz

2.8. AUXILIARY CONTROL DEVICES

2.8.1. Automatic Control Valves

- 2.8.1.1. Automatic control valves, shall be globe type valves. Valves and actuators shall be ordered as one factory-assembled and tested unit. Control ball valves will not be accepted.
- 2.8.1.2. Submit to the Consultant for review the following information for each valve:
 - 2.8.1.2.1. Valve type and size
 - 2.8.1.2.2. Connection type
 - 2.8.1.2.3. Line size
 - 2.8.1.2.4. Valve manufacturer and model number
 - 2.8.1.2.5. Valve flow coefficient
 - 2.8.1.2.6. Design flow
 - 2.8.1.2.7. Pressure drop across valve.
 - 2.8.1.2.8. Maximum close-off pressure
 - 2.8.1.2.9. Actuator manufacturer and model number
 - 2.8.1.2.10. Actuator maximum torque
- 2.8.1.3. Valves 2" (50mm) and smaller shall be constructed of bronze. Valves 2½" (65mm) and larger shall have iron bodies and bronze mountings.
- 2.8.1.4. All control valves shall have stainless steel stems. The bronze in bodies and bonnets of all bronze valves shall conform to ASTM B62 for valves rated up to

150psig (1035 Kpa) working pressure and to ASTM B61 for valves rated at 200 psig (1380 Kpa) working pressure. The bodies and bonnets of iron body valves shall conform to ASTM A126, Class B.

- 2.8.1.5. Control valve discs and seats shall be of bronze for 100 °C or less fluid temperature and of stainless steel for fluid temperatures above 100 °C.
- 2.8.1.6. The control valves shall have tight shut-off. Flat disk valves are not acceptable.
- 2.8.1.7. Control valves 2" (50mm) and smaller shall be complete with screwed ends type, except for bronze valves installed in soldered copper piping which shall be complete with soldering ends. Control valves larger than 2" (50mm) shall be complete with flanged end type and proper flanged adapters to copper shall be provided where flanged valves are installed in copper piping.
- 2.8.1.8. The water control valves shall be sized for a pressure drop of 6 ft. water column or as indicated on mechanical drawings.
- 2.8.1.9. Each automatic control valve must provide the design output and flow rates at pressure drops compatible with equipment selected.
- 2.8.1.10. Each automatic control valve must be suitable for the particular system working pressure.
- 2.8.1.11. Each automatic control valve shall be fitted with a position indicator.
- 2.8.1.12. All the same type control valves shall be the products of a single manufacturer and have the manufacturer's name, pressure rating and size clearly marked on the outside of the body.
- 2.8.1.13. All heating valves: default position shall be fully open to the coil.
- 2.8.1.14. Valves providing two-position service shall be quick opening. Two-way valves shall have replaceable disc or ball.
- 2.8.1.15. Close-off (Differential) Pressure Rating. Valve actuator and trim shall provide the following minimum close-off pressure ratings.
- 2.8.1.16. Two-way: 150% of total system (pump) head.
- 2.8.1.17. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
- 2.8.1.18. Ports. Valves providing modulating service shall have equal percentage ports.
- 2.8.1.19. Sizing.
 - 2.8.1.19.1. Two-position service: line size.
 - 2.8.1.19.2. Two-way modulating service: select pressure drop equal to the greatest of twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 35 kPa (5 psi).
 - 2.8.1.19.3. Three-way modulating service: select pressure drop equal to the smaller of twice the pressure drop through the coil exchanger (load) or 35 kPa (5 psi).
- 2.8.1.20. Standard of Acceptance: Belimo
- 2.8.2. Electric Damper and Valve Actuators.

- 2.8.2.1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
 - 2.8.2.2. Spring-return Mechanism. Actuators used for power-failure, heating and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS), unless otherwise specified
 - 2.8.2.3. Signal and Range. Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have a 2-10 Vdc or 4-20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)
 - 2.8.2.4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
 - 2.8.2.5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N•m (60 in.-lb) torque capacity shall have a manual crank.
 - 2.8.2.6. Standard of Acceptance: Belimo
- 2.8.3. Positive positioning Relays.
- 2.8.3.1. Whenever a controller has to proportion more than one motor on a single damper, a positive positioning relay must be used. Whenever a controller has to sequence two or more devices, such as valves or dampers, and for all damper operators on modulating dampers, positive positioning relays must be used. Sequencing by spring ranges alone will not be acceptable. Positive positioning relays have positive mechanical feedback of the controlled device, ratio relays are not acceptable.
- 2.8.4. Switches
- 2.8.4.1. Pressure electric switches have diaphragm operated D.P.D.T. snap acting contacts with electrical rating suitable for applications as specified. Pressure electric switches withstand up to 25 psig. And are provided with adjustable cut-in and cutout settings between 3 and 20 psig.
 - 2.8.4.2. Water flow switches are general purpose with a paddle actuated snap acting D.P.D.T. switch rated at 16 amp 120/1/60 A.C.
 - 2.8.4.3. Air proving (differential pressure) switches utilize a differential pressure activated, diaphragm actuated, snap acting D.P.D.T. switch rated at 9.8 amp 120/1/60 A.C. full load. Select differential pressure range to suit the application and setpoint is adjustable. Mount switches with diaphragm in a vertical plane. Switches are CSA approved.
 - 2.8.4.4. Install minimum positioning switches inside local cabinets and lock switches after system balancing.

- 2.8.4.5. Damper end switches are DPDT, lever operated, activated by damper blade movement and mounted securely on damper frame. Switches have contact ratings of 5A at 120 VAC and are CSA approved.

2.8.5. Electronic Temperature Sensors

- 2.8.5.1. All mixed air sensors are 1000 ohm nickel, resistance temperature detector (RTD) type with a twenty-five foot averaging element. Accuracy of the RTD sensor shall be $\pm 0.6^{\circ}\text{C}$ over a range of -7°C to 49°C (19°F to 120°F).
- 2.8.5.2. All supply and return air sensors are 1000 ohm nickel RTD type temperature detectors. The sensor probe has a minimum length of 450mm (18"). The accuracy of the sensor is $\pm 0.6^{\circ}\text{C}$ over a range of 4°C to 66°C (39°F to 151°F).
- 2.8.5.3. All space sensors (unless noted differently on drawings) are 1000 ohm nickel RTD type temperature detectors. All space sensors are provided with vented protective covers, local temperature adjustment of $\pm 1^{\circ}\text{C}$ from setpoint, built in occupancy sensor. There shall be no temperature display.
- 2.8.5.4. Local temperature adjustment is by two cap touch buttons and LED scale (no actual temperature gradients will be accepted). The accuracy of the sensor is $\pm 0.6^{\circ}\text{C}$ over a range of 4°C to 49°C (39°F to 120°F).
- 2.8.5.5. All space sensors for vestibules, corridors and other high traffic areas shall be nickel RTD stainless steel plate temperature sensor 100 ohm. Equal to Enercorp.
- 2.8.5.6. All liquid immersed sensors are 1000 ohm nickel RTD type temperature detectors. Each sensor is provided with a stainless steel well, suitable for the working temperature and pressure of the fluid. The accuracy of the sensor is $\pm 0.6^{\circ}\text{C}$ over a range of -7°C to 49°C (19°F to 120°F).
- 2.8.5.7. Outdoor air sensor is the 1000 ohm nickel RTD type temperature detector. The RTD sensor is mounted in a weatherproof enclosure. The accuracy of the sensor is $\pm 0.6^{\circ}\text{C}$ over a range of -40°C to 40°C (-40°F to 120°F).
- 2.8.5.8. All sensor elements other than those for space sensors shall be housed in a factory-made stainless-steel sheath.
- 2.8.5.9. All sensors shall be calibrated and linearized. Include a written documentation of individual sensors for records.

2.8.6. Duct Averaging Temperature Sensors

- 2.8.6.1. Provide plenum mounted mixed air temperature averaging type sensors with the following minimum characteristics:
 - 2.8.6.1.1. Constructed of FT6 plenum rated cable incorporating a minimum of 9 temperature sensors encapsulated at equal distances along the 24 foot length of the element. The assembly acts as a single sensor reporting the average temperature from all individual sensors.
 - 2.8.6.1.2. End-to-end accuracy $\pm 0.3^{\circ}\text{C}$.

2.8.6.1.3. Mount in a zigzag manner to provide continuous coverage of the entire duct cross-sectional area.

2.8.6.1.4. The use of thermistor type sensors is required.

2.8.6.2. Standard of Acceptance: Greystone

2.8.7. Outdoor Air Temperature Sensors

2.8.7.1. Provide outdoor air temperature sensors with the following minimum characteristics:

2.8.7.1.1. Each sensor shall be 10Kohm thermistor probe

2.8.7.1.2. Provide two sensors for each site.

2.8.7.1.3. Both sensors shall be mounted inside a heavy-duty (blow-proof) solar shield.

2.8.7.1.4. Provide a heavy-duty, metal, wire guard.

2.8.7.2. Standard of Acceptance: Greystone

2.8.8. CO₂ Sensor

2.8.8.1. Provide CO₂ sensors for either wall or duct mounting applications as specified. Provide a heavy duty metal guard to protect the sensor when mounted on walls. Provide the factory-supplied duct mounting kit for all duct mount applications.

2.8.8.2. The sensor shall be microprocessor controlled, fully digital, non-dispersive dual wavelength infrared technology with temperature compensation. The device output shall be 4 to 20mA.

2.8.8.3. The sensor shall have a measurement range of 0 to 3000ppm with an accuracy of +/-25ppm in the 15-30C range. Long term stability shall be no greater than 20 ppm per year. The user selectable range shall be 0 to 1500ppm.

2.8.8.4. Install the sensor in accordance with all manufacturer's instructions. Wall mounted sensors shall be installed at a minimum height of 72" above the finished floor. Sensors shall not be mounted on an outside wall, close to a window, door or in draft areas with direct airflow.

2.8.8.5. The standard of acceptance shall be Greystone

2.8.9. Air Differential Pressure Transmitters

2.8.9.1. Provide differential pressure transmitters to sense differential pressure and convert to a proportional electrical output in applications such as pressure independent Variable Air Volume terminals, S/A duct static pressure, etc. The differential pressure range is selected to match the applications. Select materials suitable for the measured variable, i.e. water and air, and to withstand a minimum of twice the normal working pressure.

2.8.9.2. Each sensor is provided with an industry standard 4-20 mA transmitter, mounted at the sensor not the SCU or panel unless in a finished area. The transmitter and sensor have a combined accuracy of 0.5% of the differential pressure range.

- 2.8.9.3. Static pressure pickups within finished areas are in blank thermostat cases. Outside static pressure reference heads are complete with a wind baffle cap to eliminate wind pressure effects. The static pressure controller is of the slack diaphragm type with a minimum setpoint range of .01 inches to 6.0 inches W.G.

2.8.10. Liquid Pressure Differential Transmitters

- 2.8.10.1. The differential pressure transmitter is designed with dual remote sensors that enable it to accept high pressure in ranges up to 500 PSI. All models are rated for overload pressure 2X the maximum fully scale range and burst pressure is 5X the maximum full scaled range. Features include field selectable pressure ranges and output signal types, output reversal and slow damping, port swapping and bidirectional measurements for the most flexible applications. The output signal is factory calibrated and temperature compensated for the highest start-up accuracy.
- 2.8.10.2. Provide a 3-valve manifold assembly (optional kit to be ordered with sensor) to facilitate sensor servicing and maintenance.
- 2.8.10.3. Coordinate with the mechanical contractor to provide a pressure tap complete with shut-off valve and "pig tail" tubing (primed with water) for each sensor used to monitor steam pressure.
- 2.8.10.4. Specifications:
- 2.8.10.4.1. Power Supply: 24 Vac/dc $\pm 10\%$ (non-isolated half-wave rectified)
 - 2.8.10.4.2. Output Signal: 4-20 mA sourcing, 0-5/0-10 Vdc (switch selectable)
 - 2.8.10.4.3. LCD: 35 x 15 mm (1.4 x 0.6"), 2-line x 8-character
 - 2.8.10.4.4. Accuracy: $\pm 1\%$ full scale of selected range (range 4 is $\pm 2\%$)
 - 2.8.10.4.5. Stability: $\pm 0.25\%$ FS typical (1 year)
 - 2.8.10.4.6. Pressure Ranges: 4 per model (menu selectable)
 - 2.8.10.4.7. Media Compatibility: 17-4 PH stainless steel
 - 2.8.10.4.8. Proof Pressure: 2X highest range per model
 - 2.8.10.4.9. Burst Pressure: 20X highest range per model
 - 2.8.10.4.10. Pressure Cycles: > 100 million
 - 2.8.10.4.11. Sensor Operating Range: -40 to 105°C (-40 to 221°F)
 - 2.8.10.4.12. Operating Environment: 0 to 50°C (32 to 122°F), 10 to 90 %RH non-condensing
 - 2.8.10.4.13. Pressure Connection: 1/4" NPT male
 - 2.8.10.4.14. Sensor Housing: IP67
 - 2.8.10.4.15. Remote Sensor Cable: S: FT-6 plenum rated, A: Armored Flexible S/S
 - 2.8.10.4.16. Wiring Connection: 14-22 AWG screw terminal block
 - 2.8.10.4.17. Enclosure: Polycarbonate, UL94-V0, IP65 (NEMA 4X)
- 2.8.10.5. Standard of Acceptance: Schneider EPW series or equivalent

2.8.11. Control Relays

2.8.11.1. Control relays are DPDT for control of electrical starters and equipment where shown on the Point Schedule.

2.8.11.2. Coil voltage matches the Unit Controller. Contacts are rated at 5A at 120 VAC.

2.8.12. Time Delay Relays

2.8.12.1. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable $\pm 100\%$ from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

2.8.12.2. Standard of Acceptance: Enercorp

2.8.13. Override Timers

2.8.13.1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0-6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.

2.8.14. Current Transmitters

2.8.14.1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4-20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be $\pm 1\%$ full-scale at 500 ohm maximum burden.

2.8.14.2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.

2.8.14.3. Unit shall be split-core type for clamp-on installation on existing wiring.

2.8.15. Current Transformers

2.8.15.1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.

2.8.15.2. Transformers shall be available in various current ratios and shall be selected for $\pm 1\%$ accuracy at 5 A full-scale output.

2.8.15.3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

2.8.16. Voltage Transmitters

2.8.16.1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4-20 mA output with zero and span adjustment.

2.8.16.2. Adjustable full-scale unit ranges shall be 100-130 Vac, 200-250 Vac, 250-330 Vac, and 400-600 Vac. Unit accuracy shall be $\pm 1\%$ full-scale at 500 ohm maximum burden.

2.8.16.3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.

2.8.17. Voltage Transformers

2.8.17.1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.

2.8.17.2. Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide $\pm 0.5\%$ accuracy at 24 Vac and 5 VA load.

2.8.17.3. Windings (except for terminals) shall be completely enclosed with metal or plastic.

2.8.18. Power Monitors

2.8.18.1. Power monitors shall be three-phase type and shall have three-phase disconnect and shorting switch assembly, UL listed voltage transformers, and UL listed split-core current transformers.

2.8.18.2. Power monitors shall provide selectable output: rate pulse for kWh reading or 4-20 mA for kW reading. Power monitors shall operate with 5 A current inputs and maximum error of $\pm 2\%$ at 1.0 power factor or $\pm 2.5\%$ at 0.5 power factor.

2.8.19. Current Switches

2.8.19.1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

2.8.20. Current Sensors (Analog)

2.8.20.1. Current sensors (CT) shall be used for status monitoring of all motor-driven equipment, where specified.

2.8.20.2. Technical Performance – Output should be only 4-20mA only. Voltage output will not be accepted. End-to-end accuracy $\pm 1\%$ of full scale at each range.

2.8.20.3. The current sensors shall be mounted inside the starter cabinets whenever possible. If this is not possible due to space limitation, provide an enclosure to house the sensor.

2.8.20.4. Standard of Acceptance: Enercorp

2.8.21. Status Relays (Solid State)

2.8.21.1. The status relays shall be mounted inside newly provided enclosures mounted near the respective equipment starter cabinets.

- 2.8.21.2. Standard of Acceptance: Omron Low-Voltage Space Thermostats. Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C-30°C (55°F-85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.
- 2.8.22. Variable Speed Drives
 - 2.8.22.1. Refer to Section: 23 05 00 Common Work Results for HVAC.
- 2.8.23. Fire stopping and Smoke Seal Materials
 - 2.8.23.1. Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with CAN4-S115-M85, for installation in U.L.C. designated firestopping and smoke seal Systems. These Systems shall provide a positive fire, water and smoke seal and a fire- resistance rating (flame, smoke hose stream and temperature) not less than the fire resistance rating of surrounding construction.
 - 2.8.23.2. Materials shall form ULC listed or UL classified assemblies and be compatible with abutting dissimilar materials and finishes.
 - 2.8.23.3. Standard of Acceptance:
 - 2.8.23.3.1. 3M Canada Limited
 - 2.8.23.3.2. A/D Fire Protection System Ltd.
 - 2.8.23.3.3. Fire Stop System
- 2.8.24. Wall Opening Covering Plates
 - 2.8.24.1. All hole covering plates used on this project shall be stainless steel 18-8 chrome metal alloy, type 302, non-magnetic type for finished areas and pressed steel for unfinished areas. Finish brush marks shall be run in a vertical direction.
- 2.8.25. Access Doors
 - 2.8.25.1. Access doors installed in unfinished areas shall be constructed of 12 ga prime coated steel and of stainless steel for all areas finished with tile or marble surfaces.
 - 2.8.25.2. Access doors shall be complete with 180° opening door, round safety corners, concealed hinges, screwdriver latches, plaster lock and anchor straps.
 - 2.8.25.3. Access doors shall be 24'x 24' or 12'x 18' as per site condition.
 - 2.8.25.4. Access doors in fire rated construction shall be ULC listed and labeled and of a rating to maintain the fire separation integrity.
 - 2.8.25.5. Standard of Acceptance:
 - 2.8.25.5.1. Zurn Industries Canada Limited
 - 2.8.25.5.2. LeHage Industries Limited
 - 2.8.25.5.3. Acudor Acorn Limited.

2.8.26. Local Control Panels

- 2.8.26.1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.
- 2.8.26.2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.
- 2.8.26.3. Each local panel shall have a control power source power switch (on-off) with over current protection.

2.9. FAIL STATE POSITION OF OUTPUTS

- 2.9.1. Unless specified otherwise, configure BAS output points for the following fail state (e.g. device position upon panel failure):

2.9.1.1.	All Fans	OFF
2.9.1.2.	Heating Valves	Full heat to terminal device
2.9.1.3.	Mixing Dampers	Full recirculation air
2.9.1.4.	Face/Bypass Dampers	Full to face
2.9.1.5.	Zone Dampers	Full heat
2.9.1.6.	Heating Pumps	ON (except boiler belly pumps)
2.9.1.7.	Boiler Belly Pumps	OFF
2.9.1.8.	Variable Frequency Drives	ON, minimum programmed speed
2.9.1.9.	Lighting Relays	Last State
2.9.1.10.	Boilers (1 stage)	ON
2.9.1.11.	Boilers (Multi-stage)	LOW ON, HIGH OFF
2.9.1.12.	Cooling Equipment	OFF
2.9.1.13.	Electric Heating	OFF
2.9.1.14.	Domestic Hot Water Pumps	OFF
2.9.1.15.	Roof-top Gas Burners	OFF

2.10. LAN CABLING

- 2.10.1. All LAN cabling shall be Category V as defined by EIA/TIA 568A. The contractor shall test all cabling to verify that 100Mb bandwidth is supported. See commissioning requirements.
- 2.10.2. Cabling shall be 4 pair, 100 ohm UTP, #24 AWG solid copper conductor PVC insulated, with blue or grey colour coded jacket. FT6 rated cable shall be used unless otherwise required to meet building codes or by-laws.

- 2.10.3. Data outlets shall be RJ45, 8 pin connectors, with 50 microns of hard gold over nickel, minimum durability of 750 mating cycles and contact pressure of 100 grams per contact. Transmission characteristics shall meet TSB-40 Category V.
- 2.10.4. Provide one RJ45 data outlet adjacent to each device to be terminated (e.g. workstation PC, DDC panel, hub, etc.) Use a flexible patch cable to connect from the data outlet to the end device. For Delta Controls installations, provide a duplex data outlet at the workstation PC to accommodate the remote security key wiring. LAN cabling shall not be directly terminated to any device.
- 2.10.5. Provide protection from EMI sources in accordance with CSA-T530 article 4
- 2.10.6. The contractor shall test all cabling to verify conformance with TIA /EIA TSB-67 - Basic Link Test using a Level 2, bi-directional tester. See commissioning requirements.
- 2.10.7. Where there are more than 2-90 degree in a conduit run, provide a pull box between sections so that there are two bends or less in any one section.
- 2.10.8. Where a conduit run requires a reverse bend, between 100 degrees and 180 degrees, insert a pull box at each bend having an angle from 100 degrees to 180 degrees.
- 2.10.9. Ream all conduit ends and install insulated bushings on each end.
- 2.10.10. Terminate all conduits that protrude through the structural floor 2" above the concrete base.
- 2.10.11. Do not use a pull box in lieu of a conduit bend. Align conduits that enter a pull box from opposite ends with each other.
- 2.10.12. FIBER OPTIC CABLE SYSTEM
- 2.10.13. Optical Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. Sheath shall be UL listed OFNP in accordance with NEC Article 770. Optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125mm.
- 2.10.14. Connectors. Field terminate optical fibers with ST type connectors. Connectors shall have ceramic ferrules and metal bayonet latching bodies.

2.11. WIRING AND RACEWAYS

- 2.11.1. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.
- 2.11.2. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 3 - EXECUTION

3.1. EXAMINATION

- 3.1.1. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Consultant for resolution before starting rough-in work.
- 3.1.2. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Consultant for resolution before starting rough-in work.
- 3.1.3. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Consultant and obtain written instructions for changes necessary to accommodate this Section's work with work of others. Controls Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2. PROTECTION

- 3.2.1. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.
- 3.2.2. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3. COORDINATION

- 3.3.1. Site.
 - 3.3.1.1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
 - 3.3.1.2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.
- 3.3.2. Life Safety.
 - 3.3.2.1. Duct smoke detectors required for air handler shutdown are provided under Division 16 and/or are existing. Interlock smoke detectors to air handlers for shutdown.
 - 3.3.2.2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23 and/or are existing. Interlock smoke dampers to air handlers

- 3.3.2.3. Coordination with Other Controls. Integrate with and coordinate controls and control devices furnished or installed by others as follows.
- 3.3.2.4. Communication media and equipment shall be provided as specified herein
- 3.3.2.5. Each supplier of a controls product shall configure, program, start up, and test that product to meet the sequences of operation described herein regardless of where within the contract documents those products are described.
- 3.3.2.6. Coordinate and resolve incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.
- 3.3.2.7. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
- 3.3.2.8. Controls Contractor shall be responsible for integration of control products provided by multiple suppliers regardless of where integration is described within the contract documents.

3.4. GENERAL WORKMANSHIP

- 3.4.1. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.
- 3.4.2. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.
- 3.4.3. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.
- 3.4.4. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.
- 3.4.5. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.5. FIELD QUALITY CONTROL

- 3.5.1. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in this section (Codes and Standards).
- 3.5.2. Continually monitor field installation for code compliance and workmanship quality.
- 3.5.3. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

3.6. EXISTING EQUIPMENT

- 3.6.1. Wiring. Interconnecting control wiring shall be removed and shall become Contractor's property unless specifically noted or shown to be reused.
- 3.6.2. Local Control Panels. Remove and deliver existing control panels to Client.
- 3.6.3. Repair. Unless otherwise directed, Contractor is not responsible for repair or replacement of existing energy equipment and systems, valves, dampers, or actuators. Notify Consultant in writing immediately of existing equipment that requires maintenance.
- 3.6.4. Indicator Gauges. Ensure operation of and recalibrate for reasonable accuracy or replace existing gauges.
- 3.6.5. Room Thermostats. Remove and deliver existing room thermostats to Client unless otherwise noted. Patch and finish holes and marks left by removal to match existing walls.
- 3.6.6. Electronic Sensors and Transmitters. Remove and deliver existing sensors and transmitters to Client.
- 3.6.7. Controllers and Auxiliary Electronic Devices. Remove and deliver existing controllers and auxiliary electronic devices to Client.
- 3.6.8. Damper Actuators, Linkages, and Appurtenances: Remove and deliver existing damper actuators, linkages and appurtenances to Client.
- 3.6.9. Control Valves. Replace existing control valves with new. Deliver removed control valves to Client.
- 3.6.10. Existing System Operating Schedule. Existing mechanical system may be disabled during this work.
- 3.6.11. Maintain fan scheduling using existing or temporary time clocks or control systems throughout the control system installation.
- 3.6.12. Modify existing starter control circuits if necessary to provide hand-off-auto control of each controlled starter. Furnish new starters or starter control packages as required.
- 3.6.13. Patch holes and finish to match existing walls.
- 3.6.14. At Client's request, items to be delivered to Client shall instead be properly disposed of. Hazardous materials shall be disposed in accordance with current regulations and applicable by-laws.

3.7. WIRING

- 3.7.1. Control and interlock wiring and installation shall comply with national and local electrical codes, and manufacturer's recommendations.

- 3.7.2. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC.
- 3.7.3. All wiring shall be installed in EMT conduit unless specified otherwise. Exposed wiring in finished areas (e.g. corridors, classrooms, gymnasiums, etc.) shall be installed in wiremold (colour to match surrounding area)
- 3.7.4. Wiring from DDC controllers to sensors and actuators and control system network and low voltage wiring running in accessible ceilings may be installed using LVT cable. Where the ceiling is used as a return air plenum, plenum rated cable shall be used in lieu of LVT cable.
- 3.7.5. Install EMT and cable at right angles to building lines, securely fastened, and in accordance with current electrical codes and standards.
- 3.7.6. Power and control wiring shall be copper conductor (RW90). For power wiring, provide #12 AWG (minimum) with a 3% maximum voltage drop in accordance with CEC requirements. Control wiring shall be a minimum of #14 AWG, unless otherwise specified.
- 3.7.7. The wires smaller than 18 gauge shall not be used and will not be accepted on the project except for: wiring between terminal computer devices, wire in standard communication cables, such as printers and short haul modems, wire used in communication networks, i.e. any cable transferring digital data, using twisted shielded pairs.
- 3.7.8. The wiring from panels to devices shall be installed without splices. The use of crimp connectors is not allowed when connecting field wiring to sensor or device leads. The use of wire nuts is acceptable in this application.
- 3.7.9. Power for control system shall not be obtained by tapping into miscellaneous circuits that could be inadvertently switched off. Only dedicated circuit(s) shall power the control system. Provide additional breakers or electrical panels as required.
- 3.7.10. Mount transformers and other peripheral equipment in panels located in serviceable areas. Provide line-side breakers/fuses for each transformer.
- 3.7.11. All 120 VAC power for any controls equipment shall be from dedicated circuits. Provide a breaker lock for each breaker used to supply the control system. Update the panel circuit directory.
- 3.7.12. A dedicated power circuit may be used to power DDC panels and equipment within the same or adjoining mechanical rooms. The use of one power circuit to power DDC panels distributed throughout the building is not acceptable.

3.7.13. The controller may be powered from the equipment that it is directly controlling (i.e. heat pump, rooftop unit) only if the controller controls no other equipment and the power supply to the controller remains energized independently of unit operation or status.

3.7.14. Provide all required code gauge boxes, connectors and other wiring accessories.

3.7.15. For all DC wiring, positive conductors shall be WHITE or RED in colour while negative conductors shall be BLACK in colour.

3.8. COMMUNICATION WIRING

3.8.1. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.7 (Wiring).

3.8.2. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

3.8.3. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.

3.8.4. Verify entire network's integrity following cable installation using appropriate tests for each cable.

3.8.5. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.

3.8.6. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.

3.8.7. Label communication wiring to indicate origination and destination.

3.8.8. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.8.9. BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135. This includes but is not limited to:

3.8.9.1. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot.)

3.8.9.2. The maximum length of an MS/TP segment is 1200 meters (4000 ft) with AWG 18 cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485.

3.8.9.3. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.

3.8.9.4. An MS/TP EIA-485 network shall have no T connections.

3.9. FIBER OPTIC CABLE

3.9.1. During installation do not exceed maximum pulling tensions specified by cable manufacturer. Post-installation residual cable tension shall be within cable manufacturer's specifications.

3.9.2. Install cabling and associated components according to manufacturers' instructions. Do not exceed minimum cable and unjacketed fiber bend radii specified by cable manufacturer.

3.10. INSTALLATION OF SENSORS

3.10.1. Install sensors according to manufacturer's recommendations.

3.10.2. Mount sensors rigidly and adequately for operating environment.

3.10.3. Install room temperature sensors on concealed junction boxes properly supported by wall framing.

3.10.4. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

3.10.5. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

3.10.6. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m² (1 ft²) of coil area.

3.10.7. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

3.10.8. Install outdoor air temperature sensors on north wall at designated location with sun shield complete with metal cover cage.

3.10.9. Differential Air Static Pressure.

3.10.9.1. Supply Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.

3.10.9.2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Make pressure tap connections according to manufacturer's recommendations.

3.10.9.3. Building Static Pressure. Pipe pressure sensor's low-pressure port to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe high-pressure port to a location behind a thermostat cover.

- 3.10.9.4. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.
- 3.10.9.5. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
- 3.10.9.6. Mount gauge tees adjacent to air and water differential pressure taps. Install shut-off valves before tee for water gauges.
- 3.10.9.7. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.
- 3.10.9.8. Install humidity sensors for duct mounted humidifiers at least 3 m (10 ft) downstream of the humidifier. Do not install filters between the humidifier and the sensor.

3.11. FLOW SWITCH INSTALLATION

- 3.11.1. Use correct paddle for pipe diameter.
- 3.11.2. Adjust flow switch according to manufacturer's instructions.

3.12. ACTUATORS

- 3.12.1. General. Mount actuators and adapters according to manufacturer's recommendations.
- 3.12.2. Electric and Electronic
 - 3.12.2.1. Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.
 - 3.12.2.2. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
 - 3.12.2.3. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, then tighten linkage.
 - 3.12.2.4. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
 - 3.12.2.5. Provide necessary mounting hardware and linkages for actuator installation.
 - 3.12.2.6. Valve Actuators. Connect actuators to valves with adapters approved by actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.13. WARNING LABELS

3.13.1. Affix permanent warning labels to equipment that can be automatically started by the control system.

3.13.2. Labels shall use white lettering (12-point type or larger) on a red background.

3.13.2.1. Warning labels shall read as follows.

CAUTION

This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

3.13.2.2. Affix permanent warning labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.

3.13.2.3. Labels shall use white lettering (12-point type or larger) on a red background.

3.13.2.4. Warning labels shall read as follows.

CAUTION

This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.14. IDENTIFICATION OF HARDWARE AND WIRING

3.14.1. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 5 cm (2 in.) of termination.

3.14.2. Label pneumatic tubing at each end within 5 cm (2 in.) of termination with a descriptive identifier.

3.14.3. Permanently label or code each point of field terminal strips to show instrument or item served.

3.14.4. Label control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

3.14.5. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.

3.14.6. Label room sensors related to terminal boxes or valves with nameplates.

3.14.7. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

3.14.8. Label identifiers shall match record documents.

3.14.9. Controllers

- 3.14.9.1. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.
- 3.14.9.2. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed in Appendix A (Sequences of Operation).

3.15. PROGRAMMING

- 3.15.1. Point Naming. Name points as shown on the equipment points list provided with each sequence of operation. See drawings. If character limitations or space restrictions make it advisable to shorten the name, the abbreviations given in Appendix C may be used. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, "Zone Temp 1" for Zone 1, "Zone Temp 2" for Zone 2.
- 3.15.2. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.
- 3.15.3. Application Programming. Provide application programming that adheres to sequences of operation specified in in this section. Program documentation or comment statements shall reflect language used in sequences of operation.
- 3.15.4. System Programming. Provide system programming necessary for system operation.
- 3.15.5. Operator Interface.
 - 3.15.5.1. Standard Graphics. Provide graphics as specified in this section. Show on each equipment graphic input and output points and relevant calculated points such as indicated on the applicable Points List in this section and on the drawings. Point information on graphics shall dynamically update.
 - 3.15.5.2. Install, initialize, start up, and troubleshoot operator interface software and functions (including operating system software, operator interface database, and third-party software installation and integration required for successful operator interface operation) as described in this section.

3.16. SEQUENCES OF OPERATION

- 3.16.1. As noted on the drawings, together with the list of control points.

3.17. EQUIPMENT ENCLOSURES AND LOCATIONS

- 3.17.1. Provide new enclosures for all field equipment (e.g. DDC panels, transducers, relays, etc.). Enclosures shall be equipped with a hinged door and latch. Provide a CLIENT-standard key/lock set for each enclosure.
- 3.17.2. Mount all enclosures in serviceable areas of mechanical rooms, storage rooms or janitor closets. Obtain written approval of the Consultant prior to mounting any enclosure in ceiling spaces or more than 5'-6" above the finished floor.
- 3.17.3. All transformers and power supplies for control equipment shall be installed in new dedicated metal cabinets with hinged, lockable covers located in the proximity of their dedicated controller cabinets.
- 3.17.4. Include within a DDC panel enclosure one 120 VAC duplex receptacle for portable PC power, if the controller cabinet is located further than 5'-0" from the nearest wall receptacle.
- 3.17.5. Ensure that enclosures are sized to allow for ease of servicing of all equipment contained within. Enclosures containing DDC panels shall be sized to allow for the installation of the maximum allowable number of expansion panels/Clients. Do not mount other equipment in a manner that may interfere with the future installation of expansion panels/Clients.
- 3.17.6. For enclosures containing pneumatic transducers or devices, provide one pressure gauge (1½" dial, 0-30psi) for the main air line supply.

3.18. IDENTIFICATION AND LABELING OF CONTROL EQUIPMENT

- 3.18.1. All panels must have a lamicaid tag (min. 3"x1") affixed to the front face indicating panel designation and function (i.e. "BAS Panel 1" or "Relay Panel 3").
- 3.18.2. All field sensors or devices must have a lamicaid tag (min. 3"x1") attached with tie-wrap or adhesive indicating the point software name and hardware address (i.e. AHU1-MAT, 2.IP4). Tags must be secured by screws where mounted outside of the building, in unheated spaces, in high humidity areas or where subject to vibration.
- 3.18.3. Room sensors or other sensors in finished areas must have a lamicaid tag affixed to the front cover. This tag shall be minimum 1"x ½" and indicate the point software name and hardware address.
- 3.18.4. All devices within a field enclosure shall be identified via a label or tag.
- 3.18.5. All BAS panel power sources must be identified by a label (min. 3"x1") indicating the source power panel designation and circuit number (i.e. "120vac fed from LP-2A cct #1).

- 3.18.6. All field control equipment panels fed from more than one power source must have a warning label on the front cover.
- 3.18.7. All wires shall be identified with the hardware address with a band-type self-adhesive strips or clip-on plastic wire markers at both ends.
- 3.18.8. All rotating equipment controlled by the BAS shall have a tag or label affixed indicating that the equipment may start without warning.
- 3.18.9. The location of the phone line manager shall be indicated via a label affixed to the inside cover of the modem enclosure or BAS panel.
- 3.18.10. All BAS panels will be supplied with a point's list sheet (within a plastic sleeve) attached to the inside door.
- 3.18.11. The points list shall identify the following for each point:
 - 3.18.11.1. Panel number.
 - 3.18.11.2. Panel location.
 - 3.18.11.3. Hardware address.
 - 3.18.11.4. Software name.
 - 3.18.11.5. Point description.
 - 3.18.11.6. Field device type.
 - 3.18.11.7. Point type (i.e. AI or DO).
 - 3.18.11.8. Device fail position.
 - 3.18.11.9. Device manufacturer.
 - 3.18.11.10. Model number or reference.
 - 3.18.11.11. Wire tag reference.
- 3.18.12. Provide laminated wiring diagrams for all field mounted relay enclosures. Securely attach to the inside door. Identify power panels and circuit numbers of the equipment being controlled.
- 3.18.13. Provide laminated wiring diagrams or modify existing equipment wiring diagrams wherever the BAS interfaces to other equipment. (e.g. boilers, chillers, etc.). Securely attach to the inside of the respective control cabinet.
- 3.18.14. Provide lamacoid labels indicating the required operating sequences, on the boilers and valves, where the boiler plants have manual or automatic isolating valves. Submit actual wording to the Consultant for approval prior to fabrication and installation.
- 3.18.15. Provide lamacoid or machine labels (as outlined above) for all interposing relays or contactors used in control circuits. The labels shall include the related point software name and hardware address

- 3.18.16. Provide a lamacoid label to identify the location of concealed devices above the ceiling space. Mount the label on the ceiling grid T-bar or a permanent surface adjacent to the devices. The label shall contain the wording "BAS Devices Above".
- 3.18.17. Provide lamacoid labels for all auxiliary HVAC equipment (e.g. force flow cabinets, unit ventilators, unit heater, window AC units, etc.) controlled by the BAS. Mount the labels in the vicinity of the existing thermostat or power switch for the unit. The label shall contain the wording "Under BAS Control".
- 3.18.18. Where directed by the Consultant, provide any and all additional labelling, diagrams, schematics or instructions as may be required to facilitate the correct operation and maintenance of controlled building systems.

3.19. SYSTEM HARDWARE COMMISSIONING

- 3.19.1. This contractor shall be responsible for the "end to end" commissioning, testing, verification and start-up of the complete control system hardware including panels, sensors, transducers, end devices, relays and wiring. Where applicable, this shall include any points from an existing and/or re-used automation system in the building.
- 3.19.2. The contractor shall conduct the hardware commissioning at the facility.
- 3.19.3. When the site hardware installation is 100% completed (including all labeling and documentation), the contractor shall provide written notification to the Client to schedule the hardware commissioning dates for each facility.
- 3.19.4. Client reserves the right, at its sole discretion, to discontinue site commissioning at any time if any part of the site hardware installation is found to be incomplete on the date of commissioning. If this occurs, the Contractor shall assume responsibility for any additional costs related to rescheduling of the site commissioning.
- 3.19.5. The Contractor shall prepare a hardware commissioning report containing the following information and test results:
- 3.19.5.1. Analog inputs (i.e. temperatures, pressure, etc.) shall be verified with an approved calibration device. All actual temperature readings should be with +/- 1C of the readings observed at the workstation. Record calibration adjustments and settings.
 - 3.19.5.2. Analog outputs shall be verified by manually commanding the output channel from the operator workstation to two or more positions within the 0-100% range and verifying the actual position of the actuator or device. All devices shall operate over their entire 0-100% range from a minimum control range of 10-90%. Record the actual output scale range (channel output voltage versus controller command) for each analogue end device

- 3.19.5.3. Digital outputs shall be verified by witnessing the actual start/stop operation of the equipment under control.
- 3.19.5.4. Digital inputs shall be verified by witnessing the status of the input point as the equipment is manually cycled on and off.
- 3.19.5.5. Identify any existing equipment (valves, dampers, fan starters, etc..) that are inoperative or require maintenance or repair.
- 3.19.5.6. The BAS field panel power source shall be toggled on and off to ensure reboot functionality and power down memory retention of all parameters. During the power down test, all controlled system outputs shall go to their fail-safe position.
- 3.19.5.7. The hardware commissioning report must be signed and dated by the Contractor's technician performing the tests and participating Client representative.
- 3.19.5.8. Include with the hardware commissioning report a site floor plan indicating the location of all equipment installed in concealed or recessed locations (e.g. interposing relays in ceiling spaces).
- 3.19.5.9. Provide testing of all LAN cabling to ensure that 100Mb bandwidth is supported.
- 3.19.5.10. Verify conformance with TIA /EIA TSB-67 - Basic Link Test using a Level 2, bi-directional tester. Provide all equipment necessary to carry out the required tests.
- 3.19.5.11. The Contractor shall prepare a software commissioning report containing the following information and test results:
 - 3.19.6. Alarms and Interlocks.
 - 3.19.6.1. Check each alarm with an appropriate signal at a value that will trip the alarm.
 - 3.19.6.2. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
 - 3.19.6.3. Tests interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.
- 3.19.7. Record all out-of-season or unverified points in the commissioning report as "non-commissioned".
- 3.19.8. Verify PID loop tuning parameters by applying a step change to the current setpoint and observing the response of the controlled device. Setpoint should be reached in an acceptable period of time without excessive cycling or hunting of the controlled device. Provide a graph of the trend response to setpoint change for important controlled devices (e.g. valves 1-inch or larger, dampers on major air handlers, etc.)
- 3.19.9. Provide confirmation that a series of test alarms has been successfully received at a designated remote monitoring workstations.

3.19.10. The software commissioning report must be signed and dated by the Contractor's technician performing the tests and participating Client representative.

3.19.11. At the completion of site commissioning, submit four (4) copies of each the hardware and software commissioning reports to the Client.

3.20. SUBSTANTIAL COMPLETION INSPECTION

3.20.1.1. At the completion of the site hardware inspection, the Contractor shall test and verify that the system programming, graphics and alarm software is operating correctly and is in compliance all requirements of the specifications.

3.20.1.2. The Contractor shall provide written notification to the Client that the site is ready for the Substantial Completion Inspection by the Consultant.

3.20.1.3. At the conclusion of the Substantial Completion Inspection, the Consultant shall issue a comprehensive site deficiency report to the Contractor for his immediate action.

3.20.1.4. The Contractor shall correct all items noted in the site deficiency report within ten (10) business days of receipt.

3.20.1.5. The Contractor shall provide written notification to the Client that all items on the Consultant's site deficiency report have been corrected.

3.21. CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

3.21.1. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified above. Provide Consultant with log documenting completion of Substantial Completion Inspection.

3.21.2. Consultant and Client Representative will be present to observe and review system demonstration. Notify Consultant and Client Representative at least 10 days before system demonstration begins.

3.21.3. Demonstration shall follow process submitted and approved. Complete approved checklists and forms for each system as part of system demonstration.

3.21.4. Demonstrate actual field operation of each sequence of operation as specified herein. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by Consultant. Provide and operate test equipment required to prove proper system operation.

3.21.5. Demonstrate compliance with sequences of operation through each operational mode.

3.21.6. Demonstrate complete operation of operator interface.

3.21.7. Demonstrate each of the following.

- 3.21.7.1. DDC loop response. Supply graphical trend data output showing each DDC loop's response to a setpoint change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show setpoint, actuator position, and controlled variable values. Consultant will require further tuning of each loop that displays unreasonably under- or over-damped control.
- 3.21.7.2. Building fire alarm system interface.
- 3.21.7.3. Trend logs for each system. Trend data shall indicate setpoints, operating points, valve positions, and other data as specified in the points list provided with each sequence of operation. Each log shall cover three 48-hour periods and shall have a sample frequency not less than 10 minutes or as specified on its points list. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs.
- 3.21.8. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.
- 3.21.9. Acceptance.
 - 3.21.9.1. After tests described in this specification are performed to the satisfaction of both Consultant and Client, Consultant will accept control system as meeting completion requirements. Consultant may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. Consultant will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.
- 3.21.10. System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required.

3.22. CLEANING

- 3.22.1. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.
- 3.22.2. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.
- 3.22.3. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent areas.

3.23. TRAINING

3.23.1. Provide training for a designated staff of Client's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

3.23.2. Training shall enable students to accomplish the following objectives.

- 3.23.2.1. Proficiently operate system.
- 3.23.2.2. Understand control system architecture and configuration.
- 3.23.2.3. Understand DDC system components.
- 3.23.2.4. Understand system operation, including DDC system control and optimizing routines (algorithms)
- 3.23.2.5. Operate workstation and peripherals
- 3.23.2.6. Log on and off system
- 3.23.2.7. Access graphics, point reports, and logs
- 3.23.2.8. Adjust and change system set-points, time schedules, and holiday schedules
- 3.23.2.9. Recognize common HVAC system malfunctions by observing system graphics, trend graphs, and other system tools
- 3.23.2.10. Understand system drawings and Operation and Maintenance manual
- 3.23.2.11. Understand job layout and location of control components
- 3.23.2.12. Access data from DDC controllers
- 3.23.2.13. Operate portable operator's terminals
- 3.23.2.14. Create and change system graphics
- 3.23.2.15. Create, delete, and modify alarms, including configuring alarm reactions
- 3.23.2.16. Create, delete, and modify point trend logs (graphs) and multi-point trend graphs
- 3.23.2.17. Configure and run reports
- 3.23.2.18. Add, remove, and modify system's physical points
- 3.23.2.19. Create, modify, and delete application programming
- 3.23.2.20. Add operator interface stations
- 3.23.2.21. Add a new controller to system
- 3.23.2.22. Download firmware and advanced applications programming to a controller
- 3.23.2.23. Configure and calibrate I/O points
- 3.23.2.24. Maintain software and prepare backups
- 3.23.2.25. Interface with job-specific, third-party operator software
- 3.23.2.26. Add new users and understand password security procedures

3.23.3. Divide presentation of objectives into three sessions (1-13, 14-23, and 24-26). Participants will attend one or more of sessions, depending on knowledge level required.

- 3.23.3.1. Day-to-day Operators (objectives 1-13)
- 3.23.3.2. Advanced Operators (objectives 1-13 and 14-23)
- 3.23.3.3. System Managers and Administrators (objectives 1-13 and 14-26)

- 3.23.3.4. Provide course outline and materials Provide one copy of training material per student.
- 3.23.3.5. Instructors shall be factory-trained and experienced in presenting this material.
- 3.23.3.6. Perform classroom training using a network of working controllers representative of installed hardware.

TABLE OF CONTENTS

PART 1 - GENERAL	3
1.1. DESCRIPTION	3
1.2. RELATED WORK	3
1.3. QUALITY ASSURANCE	3
1.4. SUBMITTALS	3
1.5. APPLICABLE PUBLICATIONS	4
1.6. SPARE PARTS	5
PART 2 - PRODUCTS	5
2.1. PIPE AND TUBING	5
2.2. FITTINGS FOR COPPER TUBING	6
2.3. FITTINGS FOR STEEL PIPE	6
2.4. FITTINGS FOR PLASTIC PIPING	7
2.5. DIELECTRIC FITTINGS	7
2.6. UNION	7
2.7. FLANGES	7
2.8. GASKETS AND BOLTS	8
2.9. PLUGS	8
2.10. SCREWED JOINTS	8
2.11. VALVES	8
2.12. WATER FLOW MEASURING DEVICES	11
2.13. STRAINERS	12
2.14. FLEXIBLE CONNECTORS FOR WATER SERVICE	12
2.15. EXPANSION JOINTS	12
2.16. HYDRONIC SYSTEM COMPONENTS	13
2.17. GAGES, TEMPERATURE, PRESSURE AND COMPOUND	14
2.18. PRESSURE/TEMPERATURE TEST PROVISIONS	14
2.19. FIRESTOPPING MATERIAL	14
PART 3 - EXECUTION	14
3.1. GENERAL	14
3.2. PIPE JOINTS	15

3.3.	EXPANSION JOINTS (BELLOWS AND SLIP TYPE).....	16
3.4.	BRAZING	16
3.5.	LEAK TESTING ABOVEGROUND PIPING	16
3.6.	FLUSHING AND CLEANING PIPING SYSTEMS	17
3.7.	WATER TREATMENT	18
3.8.	ELECTRIC HEAT TRACING	18
3.9.	OPERATING AND PERFORMANCE TEST AND INSTRUCTION.....	18

PART 1 - GENERAL

1.1. DESCRIPTION

1.1.1. Water piping to connect HVAC equipment, including the following:

- 1.1.1.1. Chilled water, condenser water, heating hot water and drain piping.
- 1.1.1.2. Extension of domestic water make up piping.
- 1.1.1.3. Glycol water piping.

1.2. RELATED WORK

- 1.2.1. Section: 01 33 23 Shop Drawings, Product Data, and Samples.
- 1.2.2. Section: 23 05 00 Common Work Results for HVAC.
- 1.2.3. Section: 23 21 23 Hydronic Pumps.

1.3. QUALITY ASSURANCE

- 1.3.1. Section: 23 05 00 Common Work Results for HVAC, which includes welding qualifications.
- 1.3.2. Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and not more than one year old.
- 1.3.3. All joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer.
- 1.3.4. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.4. SUBMITTALS

- 1.4.1. Submit in accordance with Section: 01 33 23 Shop Drawings, Product Data, and Samples.
- 1.4.2. Manufacturer's Literature and Data:
 - 1.4.2.1. Pipe and equipment supports.
 - 1.4.2.2. Pipe and tubing, with specification, class or type, and schedule.
 - 1.4.2.3. Pipe fittings, including miscellaneous adapters and special fittings.
 - 1.4.2.4. Flanges, gaskets and bolting.
 - 1.4.2.5. Valves of all types.
 - 1.4.2.6. Heat Exchangers.
 - 1.4.2.7. Strainers.
 - 1.4.2.8. Flexible connectors for water service.
 - 1.4.2.9. Pipe alignment guides.
 - 1.4.2.10. Expansion joints.

- 1.4.2.11. Expansion compensators.
- 1.4.2.12. All specified hydronic system components.
- 1.4.2.13. Water flow measuring devices.
- 1.4.2.14. Gages.
- 1.4.2.15. Thermometers and test wells.
- 1.4.2.16. Electric heat tracing systems.
- 1.4.2.17. Air separators.
- 1.4.2.18. Expansion tanks.
- 1.4.2.19. Submit the welder's qualifications in the form of a current (less than one year old) and formal certificate.
- 1.4.2.20. As Built Piping Diagrams: Provide drawing as follows for chilled water/glycol, condenser water, and heating hot water/glycol system and other piping systems and equipment in electronic Autocad and pdf format.

1.5. APPLICABLE PUBLICATIONS

- 1.5.1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. American National Standards Institute, Inc.

- 1.5.2. American Society of Mechanical Engineers/American National Standards Institute, Inc. (ASME/ANSI):

- 1.5.2.1. B1.20.1-83(R2006) Pipe Threads, General Purpose (Inch)
- 1.5.2.2. B16.4 06 Gray Iron Threaded Fittings
- 1.5.2.3. B16.18-01 Cast Copper Alloy Solder joint Pressure fittings
- 1.5.2.4. B16.23-02 Cast Copper Alloy Solder joint Drainage fittings
- 1.5.2.5. B40.100-05 Pressure Gauges and Gauge Attachments

- 1.5.3. American National Standards Institute, Inc./Fluid Controls Institute (ANSI/FCI):

- 1.5.3.1. 70-2-2006 Control Valve Seat Leakage

- 1.5.4. American Society of Mechanical Engineers (ASME):

- 1.5.4.1. B16.1-98 Cast Iron Pipe Flanges and Flanged Fittings
- 1.5.4.2. B16.3-2006 Malleable Iron Threaded Fittings: Class 150 and 300
- 1.5.4.3. B16.4 2006 Gray Iron Threaded Fittings: (Class 125 and 250)
- 1.5.4.4. B16.5-2003 Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard
- 1.5.4.5. B16.9-07 Factory Made Wrought Butt Welding Fittings
- 1.5.4.6. B16.11-05 Forged Fittings, Socket Welding and Threaded
- 1.5.4.7. B16.18-01 Cast Copper Alloy Solder Joint Pressure Fittings
- 1.5.4.8. B16.22-01 Wrought Copper and Bronze Solder Joint Pressure Fittings.

1.5.4.9.	B16.24 06	Cast Copper Alloy Pipe Flanges and Flanged Fittings
1.5.4.10.	B16.39 06	Malleable Iron Threaded Pipe Unions
1.5.4.11.	B16.42-06	Ductile Iron Pipe Flanges and Flanged Fittings
1.5.4.12.	B31.1 08	Power Piping

1.5.5. American Society for Testing and Materials (ASTM):

1.5.5.1.	A47/A47M-99 (2004)	Ferritic Malleable Iron Castings
1.5.5.2.	A53/A53M-07	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
1.5.5.3.	A106/A106M-08	Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service
1.5.5.4.	A126 04	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
1.5.5.5.	A183 03	Standard Specification for Carbon Steel Track Bolts and Nuts
1.5.5.6.	A216/A216M-08	Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
1.5.5.7.	A234/A234M-07	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
1.5.5.8.	A307 07	Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
1.5.5.9.	A536 84 (2004)	Standard Specification for Ductile Iron Castings
1.5.5.10.	A615/A615M-08	Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
1.5.5.11.	B32 08	Standard Specification for Solder Metal
1.5.5.12.	B62 02	Standard Specification for Composition Bronze or Ounce Metal Castings
1.5.5.13.	B88 03	Standard Specification for Seamless Copper Water Tube

1.5.6. American Water Works Association (AWWA):

1.5.6.1.	C110-08	Ductile Iron and Grey Iron Fittings for Water
1.5.6.2.	C203-02	Coal Tar Protective Coatings and Linings for Steel Water Pipe Lines Enamel and Tape Hot Applied

1.6. SPARE PARTS

- 1.6.1. For mechanical pressed sealed fittings provide tools required for each pipe size used at the facility.

PART 2 - PRODUCTS

2.1. PIPE AND TUBING

2.1.1. Chilled Water/Glycol Piping, Condenser Water Piping, Heating Hot Water/Glycol Piping as applicable to the project:

2.1.1.1. 50 mm (2") diam and smaller:

2.1.1.1.1. Schedule 40 continuous weld or electric resistance welded black carbon steel conforming to ASTM A53 84a Grade B, with threaded ends.

2.1.1.1.2. Type "L" hard drawn copper tubing conforming to ASTM B88. Type "L" soft annealed copper tubing may be used within convector enclosures.

2.1.1.2. 65 mm (2½") diam and larger

2.1.1.2.1. Schedule 40 continuous weld or electric resistance welded black carbon steel conforming to ASTM A53 84a Grade B, with beveled ends.

2.1.2. Cooling Coil Condensate Drain Piping:

2.1.2.1. From air handling units: Copper water tube, ASTM B88, Type M

2.1.2.2. From fan coil or other terminal units: Copper water tube, ASTM B88, Type L for runouts and Type M for mains.

2.1.3. Chemical Feed Piping for Cooling Tower Water Treatment: Chlorinated polyvinyl chloride (CPVC), Schedule 80, ASTM F441.

2.1.4. Pipe supports, including insulation shields, for above ground piping: Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

2.2. FITTINGS FOR COPPER TUBING

2.2.1. Joints 50 mm (2") and smaller:

2.2.1.1. *Solder Joints:* Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.

2.2.1.2. *Screwed Joints:* Pipe Thread: ANSI B1.20. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.2.2. Joints 65 mm (2½") and larger:

2.2.2.1. Bronze Flanges and Flanged Fittings: ASME B16.24.

2.2.2.2. Fittings: ASME B16.18 cast copper or ASME B16.22 solder wrought copper.

2.3. FITTINGS FOR STEEL PIPE

2.3.1. 50 mm (2 inches) and Smaller: Screwed or welded joints.

2.3.1.1. Butt welding: ASME B16.9 with same wall thickness as connecting piping.

2.3.1.2. Forged steel, socket welding or threaded: ASME B16.11.

- 2.3.1.3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.

- 2.3.2. 65 mm (2 1/2 inches) and Larger: Welded or flanged joints.

- 2.3.2.1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
- 2.3.2.2. Welding flanges and bolting: ASME B16.5:
- 2.3.2.3. Weld neck or slip on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).
- 2.3.2.4. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.

2.4. FITTINGS FOR PLASTIC PIPING

- 2.4.1. Chemical feed piping for condenser water treatment: Chlorinated polyvinyl chloride (CPVC), Schedule 80, ASTM F439.

2.5. DIELECTRIC FITTINGS

- 2.5.1. Provide where copper tubing and ferrous metal pipe are joined.
- 2.5.2. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.
- 2.5.3. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.
- 2.5.4. Temperature Rating, 99 degrees C (210 degrees F).

2.6. UNION

- 2.6.1. 50 mm (2") diam and smaller:
 - 2.6.1.1. All brass construction with ground joint and either solder joint or screwed ends as required.
 - 2.6.1.2. Class 150 black malleable iron construction with brass to iron ground joint and screwed ends, conforming to ASTM A197 and ANSI/ASME B1.20.1.
 - 2.6.1.3. Provide dielectric unions or couplings at all connections between copper tubing and ferrous piping or equipment.

2.7. FLANGES

- 2.7.1. Class 150 forged steel slip-on or weld-neck raised face type conforming to ASTM A181 Grade 1 and ANSI/ASME B16.5. Remove raised face where flanges connect to Class 125 cast iron valves.

2.7.2. Hinged, two piece, shouldered or keyed cast malleable iron

2.7.3. Conforming to ASTM A47 Grade 32510 with elastomeric gasket suitable for service and lock bolt.

2.8. GASKETS AND BOLTS

2.8.1. Gaskets

2.8.1.1. 1.6 mm (1/16") Garlock 3200 with SBR binder or equivalent asbestos free material.

2.8.2. Bolts

2.8.2.1. Semi finished hex head machine bolts and semi finished hex nuts, both of carbon steel conforming. to ASTM A307 Class A.

2.9. PLUGS

2.9.1. 50 mm (2") diam and smaller

2.9.2. Class 3000 screwed, square head, machined from solid steel or forging to ASTM A105 Grade 2.

2.10. SCREWED JOINTS

2.10.1. Pipe Thread: ANSI B1.20.

2.10.2. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.11. VALVES

2.11.1. Asbestos packing is not acceptable.

2.11.2. All valves of the same type shall be products of a single manufacturer.

2.11.3. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.

2.11.4. Standard of Acceptance: Crane, Toyo, Kitz, RWV

2.11.5. Shut-Off Valves

2.11.5.1. Ball Valves (Pipe sizes 50 mm [2"] and smaller): MSS-SP 110, screwed or solder connections, brass or bronze body with chrome-plated ball with full port and Teflon seat at 2760 kPa (400 psig) working pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.

- 2.11.5.2. Butterfly Valves (Pipe Sizes 65 mm [2-1/2"] and larger): Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation. MSS SP 67, flange lug type end rated 1205 kPa (175 psig) working pressure at 93 degrees C (200 degrees F). Valves shall be ANSI Leakage Class VI and rated for bubble tight shut-off to full valve pressure rating. Valve shall be rated for dead end service and bi-directional flow capability to full rated pressure. Not permitted for direct buried pipe applications.
- 2.11.5.2.1. Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65 45 12 electro-plated.
- 2.11.5.2.2. Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.
- 2.11.5.2.3. Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.
- 2.11.5.2.4. Valves 150 mm (6 inches) and smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.
- 2.11.5.2.5. Valves 200 mm (8 inches) and larger: Enclosed worm gear with handwheel, and where required, chain wheel operator.
- 2.11.5.3. Globe and Angle Valves
- 2.11.5.3.1. Globe Valves
- 50 mm (2 inches) and smaller: MSS SP 80, bronze, 1034 kPa (150 lb.) Globe valves shall be union bonnet with metal plug type disc.
 - 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS SP 85 for globe valves.
- 2.11.5.3.2. Angle Valves:
- 50 mm (2 inches) and smaller: MSS SP 80, bronze, 1034 kPa (150 lb.) Angle valves shall be union bonnet with metal plug type disc.
 - 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS SP 85 for angle.
- 2.11.5.3.3. Check Valves
- Swing Check Valves:
 - 50 mm (2 inches) and smaller: MSS SP 80, bronze, 1034 kPa (150 lb.), 45 degree swing disc.
 - 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS SP 71 for check valves.
 - Non Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.

- Body: MSS-SP 125 cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.
- Seat, disc and spring: 18 8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.

2.11.5.3.4. Water Flow Balancing Valves: For flow regulation and shut off. Valves shall be line size rather than reduced to control valve size.

- Standard of Acceptance: Crane, Toyo, Kitz, RWV, Armstrong
- General

Globe style valve.

Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

Standard of Acceptance: Armstrong CBV series, Taco, Tour and Anderson

- Valves ½" to 2" diam:

Valves are to be of the 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off.

Valve shall provide multi-turn, 360° adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360° handwheel turns. 90° 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced.

Valves shall be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi shall have two, ¼" threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves shall be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug shall be brass. The handwheel shall be high-strength resin.

- Valves 2-1/2" to 12" diam:

Valves are to be of the 'Y' pattern, equal percentage globe-style and provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip-tight shut-off.

Valve shall provide multi-turn, 360° adjustment with micrometer type indicators located on the valve handwheel. Valves shall have a minimum of five full 360° handwheel turns. 90° 'circuit-setter' style ball valves are not acceptable. Valve handle shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced.

Valves shall be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi shall have two, ¼" threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves shall be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug shall be brass. The handwheel shall be high-strength resin.

2.11.5.3.5. Automatic Balancing Control Valves:

- Use only where specifically approved by the consultant
- Factory calibrated to maintain constant flow (plus or minus five percent) over system pressure fluctuations of at least 10 times the minimum required for control. Provide standard pressure taps and four sets of capacity charts. Valves shall be line size and be one of the following designs:
 - Gray iron (ASTM A126) or brass body rated 1205 kPa (175 psig) at 93 degrees C (200 degrees F), with stainless steel piston and spring.
 - Brass or ferrous body designed for 2067 kPa (300 psig) service at 121 degrees C (250 degrees F), with corrosion resistant, tamper proof, self cleaning piston/spring assembly that is easily removable for inspection or replacement.
- Provide a readout kit including flow meter, probes, hoses, flow charts and carrying case.
- Standard of Acceptance: Kitz, RWV

2.11.5.3.6. Manual Radiator/Convactor Valves: Brass, packless, with position indicator.

2.12. WATER FLOW MEASURING DEVICES

- 2.12.1. Minimum overall accuracy plus or minus three percent over a range of 70 to 110 percent of design flow. Select devices for not less than 110 percent of design flow rate.
- 2.12.2. Venturi Type: Bronze, steel, or cast iron with bronze throat, with valved pressure sensing taps upstream and at the throat.
- 2.12.3. Wafer Type Circuit Sensor: Cast iron wafer type flow meter equipped with readout valves to facilitate the connecting of a differential pressure meter. Each readout valve shall be fitted with an integral check valve designed to minimize system fluid loss during the monitoring process.
- 2.12.4. Self Averaging Annular Sensor Type: Brass or stainless steel metering tube, shutoff valves and quick coupling pressure connections. Metering tube shall be rotatable so all sensing ports may be pointed down stream when unit is not in use.

2.12.5. Flow Measuring Device Identification:

- 2.12.5.1. Metal tag attached by chain to the device.
- 2.12.5.2. Include meter or equipment number, manufacturer's name, meter model, flow rate factor and design flow rate in l/m (gpm).
- 2.12.5.3. Permanently Mounted Water Flow Indicating Meters: Minimum 150 mm (6 inch) diameter, or 450 mm (18 inch) long scale, for 120 percent of design flow rate, direct reading in lps (gpm), with three valve manifold and two shut off valves.

2.13. STRAINERS

2.13.1. Basket or Y Type.

- 2.13.1.1. Screens: Bronze, monel metal or 18 8 stainless steel, free area not less than 2 1/2 times pipe area, with perforations as follows: 1.1 mm (0.045 inch) diameter perforations for 100 mm (4 inches) and larger: 3.2 mm (0.125 inch) diameter perforations.
- 2.13.1.2. Suction Diffusers: Specified in Section: 23 21 23 Hydronic Pumps.

2.14. FLEXIBLE CONNECTORS FOR WATER SERVICE

- 2.14.1. Refer to Section: 23 05 48 Vibration and Seismic Controls for HVAC.

2.15. EXPANSION JOINTS

- 2.15.1. Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built or field-fabricated guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.
- 2.15.2. Manufacturing Quality Assurance: Conform to Expansion Joints Manufacturers Association Standards.
- 2.15.3. Bellows Internally Pressurized Type:
 - 2.15.3.1. Multiple corrugations of Type 304 or Type A240-321 stainless steel.
 - 2.15.3.2. Internal stainless steel sleeve entire length of bellows.
 - 2.15.3.3. External cast iron equalizing rings for services exceeding 340 kPa (50 psig).
 - 2.15.3.4. Welded ends.
 - 2.15.3.5. Design shall conform to standards of EJMA and ASME B31.1.
 - 2.15.3.6. External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in direction of pipeline.
 - 2.15.3.7. Integral external cover.

2.15.4. Bellows Externally Pressurized Type:

- 2.15.4.1. Multiple corrugations of Type 304 stainless steel.
 - 2.15.4.2. Internal and external guide integral with joint.
 - 2.15.4.3. Design for external pressurization of bellows to eliminate squirm.
 - 2.15.4.4. Welded ends.
 - 2.15.4.5. Conform to the standards of EJMA and ASME B31.1.
 - 2.15.4.6. Threaded connection at bottom, 25 mm (one inch) minimum, for drain or drip point.
 - 2.15.4.7. Integral external cover and internal sleeve.
- 2.15.5. Expansion Compensators:
- 2.15.5.1. Corrugated bellows, externally pressurized, stainless steel or bronze.
 - 2.15.5.2. Internal guides and anti torque devices.
 - 2.15.5.3. Threaded ends.
 - 2.15.5.4. External shroud.
 - 2.15.5.5. Conform to standards of EJMA.
- 2.15.6. Expansion Joint Identification: Provide stamped brass or stainless steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number on the contract drawings.
- 2.15.7. Guides: Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides must be designed to withstand a minimum of 15 percent of the axial force which will be imposed on the expansion joints and anchors. Field-built guides may be used if detailed on the contract drawings.
- 2.15.8. Supports: Provide saddle supports and frame or hangers for heat exchanger. Mounting height shall be adjusted to facilitate gravity return of steam condensate. Construct supports from steel, weld joints.

2.16. HYDRONIC SYSTEM COMPONENTS

- 2.16.1. Air Purger: Cast iron or fabricated steel, 861 kPa (125 psig) water working pressure, for in line installation.
- 2.16.2. Pressure Reducing Valve (Water): Diaphragm or bellows operated, spring loaded type, with minimum adjustable range of 28 kPa (4 psig) above and below set point. Bronze, brass or iron body and bronze, brass or stainless steel trim, rated 861 kPa (125 psig) working pressure at 107 degrees C (225 degrees F).
- 2.16.3. Pressure Relief Valve: Bronze or iron body and bronze or stainless steel trim, with testing lever. Comply with ASME Code for Pressure Vessels, Section 8, and bear ASME stamp.

2.16.4. Automatic Air Vent Valves: Automatic air vent should be used only on air separators and similar applications in mechanical rooms. When used, pipe outlet to floor drain to prevent damage from leaks. Cast iron or semi steel body, 1034 kPa (150 psig) working pressure, stainless steel float, valve, valve seat and mechanism, minimum 15 mm (1/2 inch) water connection and 6 mm (1/4 inch) air outlet. Air outlet shall be piped to the nearest floor drain.

2.17. GAGES, TEMPERATURE, PRESSURE AND COMPOUND

2.17.1. See Section: 23 05 00 Common Work Results for HVAC.

2.17.2. Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gages in water service.

2.17.3. Range of Gages: Provide range equal to at least 150 percent of normal operating range.

2.18. PRESSURE/TEMPERATURE TEST PROVISIONS

2.18.1. Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordelself closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

2.19. FIRESTOPPING MATERIAL

2.19.1. Refer to Section: 23 05 00 Common Work Results for HVAC.

PART 3 - EXECUTION

3.1. GENERAL

3.1.1. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

3.1.2. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

3.1.3. Support piping securely. Refer to Section 23 05 00, COMMON WORK RESULTS FOR HVAC.

- 3.1.4. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.
- 3.1.5. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.
- 3.1.6. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take offs with 3 elbow swing joints where noted on the drawings.
- 3.1.7. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.
- 3.1.8. Provide manual or automatic air vent at all piping system high points and drain valves at all low points. Install piping to floor drains from all automatic air vents.
- 3.1.9. Connect piping to equipment as shown on the drawings and as recommended by the manufacturer.
- 3.1.10. Install components furnished by others such as:
 - 3.1.10.1. Water treatment pot feeders and condenser water treatment systems.
 - 3.1.10.2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.
 - 3.1.10.3. Thermometer Wells: In pipes 65 mm (2 1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.
- 3.1.11. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section: 23 07 00 HVAC Insulation.
- 3.1.12. Where copper piping is connected to steel piping, provide dielectric connections.

3.2. PIPE JOINTS

- 3.2.1. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 00, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- 3.2.2. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.
- 3.2.3. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
- 3.2.4. Solvent Welded Joints: As recommended by the manufacturer.

3.3. EXPANSION JOINTS (BELLOWS AND SLIP TYPE)

- 3.3.1. Anchors and Guides: Provide type, quantity and spacing as recommended by manufacturer of expansion joint and as shown. A professional engineer shall verify in writing that anchors and guides are properly designed for forces and moments which will be imposed.
- 3.3.2. Cold Set: Provide setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.
- 3.3.3. Preparation for Service: Remove all apparatus provided to restrain joint during shipping or installation. Representative of manufacturer shall visit the site and verify that installation is proper.
- 3.3.4. Access: Expansion joints must be located in readily accessible space. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding.

3.4. BRAZING

- 3.4.1. Flux shall not be allowed to penetrate to the inside of the pipe. The outside of the tube and fittings shall be cleaned by washing with hot water in order to remove any residual flux.
- 3.4.2. During the brazing of the pipe connections, except when performing final connections and emergency repairs, the interior of the pipe shall be maintained with a nitrogen atmosphere. This shall be done by purging the pipe a sufficient number of times to remove all air and oxygen and by maintaining a small purge flow to prevent reentry of

3.5. LEAK TESTING ABOVEGROUND PIPING

- 3.5.1. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer. Tests may be either of those below, or a combination, as approved by the Resident Engineer.
- 3.5.2. An operating test at design pressure, and for hot systems, design maximum temperature.
- 3.5.3. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

3.6. FLUSHING AND CLEANING PIPING SYSTEMS

- 3.6.1. Water Piping: Clean systems as recommended by the suppliers of chemicals as per the Client standard
- 3.6.2. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/S (6 feet per second), if possible. Connect dead end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the Resident Engineer.
- 3.6.3. Cleaning: Using products, to circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 1.8 m/S (6 feet per second). Circulate each section for not less than four hours. Blow down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.

- 3.6.4. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.7. WATER TREATMENT

- 3.7.1. Install water treatment equipment and provide water treatment system piping.
- 3.7.2. Close and fill system as soon as possible after final flushing to minimize corrosion.
- 3.7.3. Charge systems with chemicals as per the Client standard
- 3.7.4. Utilize this activity, by arrangement with the Resident Engineer, for instructing VA operating personnel.

3.8. ELECTRIC HEAT TRACING

- 3.8.1. Install tracing as recommended by the manufacturer.
- 3.8.2. Coordinate electrical connections.

3.9. OPERATING AND PERFORMANCE TEST AND INSTRUCTION

- 3.9.1. Refer to PART 3 of Section: 23 05 00 Common Work Results for HVAC.
- 3.9.2. Adjust red set hand on pressure gages to normal working pressure.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. QUALITY ASSURANCE	2
1.4. QUALITY CONTROL	2
1.5. DESIGN CRITERIA	2
1.6. SUBMITTALS	3
1.7. CLOSEOUT SUBMITTALS	4
1.8. APPLICABLE PUBLICATIONS	4
1.9. DEFINITIONS	4
1.10. DELIVERY STORAGE AND HANDLING	4
1.11. SPARE MATERIALS	5
1.12. WARRANTY	5
1.13. STANDARDS OF ACCEPTANCE	5
PART 2 - PRODUCTS	5
2.1. GENERAL PUMP REQUIREMENTS:	5
2.2. VERTICAL IN-LINE CLOSE COUPLED PUMPS.	6
2.3. IN-LINE CLOSE COUPLED CIRCULATORS	7
2.4. ACCESSORIES	7
PART 3 - EXECUTION	9
3.1. INSTALLATION.....	9
3.2. ACCESSORIES	10
3.3. START UP	10

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. Hydronic pumps for Heating, Ventilating and Air Conditioning.
- 1.1.2. Includes pumps for hydronic heating and cooling service, including condensers. Includes process pumps except those covered in other specification sections.
- 1.1.3. Does not include steam condensate, domestic booster package, domestic hot water recirculation pumps, sump, or fire pumps.

1.2. RELATED WORK

- 1.2.1. Section: 01 33 23 Shop Drawings, Product Data, and Samples.
- 1.2.2. Section: 23 05 00 Common Work Results for HVAC.
- 1.2.3. Section: 23 05 13 Common Motor Requirements for HVAC Equipment.
- 1.2.4. Section: 23 05 48 Vibration and Seismic Controls for HVAC.
- 1.2.5. Section: 23 21 13 Hydronic Piping.
- 1.2.6. Section: 26 29 10 Motor Starters to 600 V.

1.3. QUALITY ASSURANCE

- 1.3.1. Refer to Paragraph, QUALITY ASSURANCE, in Section: 23 05 00 Common Work Results for HVAC.

1.4. QUALITY CONTROL

- 1.4.1. The pump control package shall be fully assembled by the manufacturer. The manufacturer shall be responsible for the complete pump control package.
- 1.4.2. Where applicable, the pump control package shall include the system interface with pumps and VFDs, as well as the successful operation of all components supplied by the pump control system manufacturer.

1.5. DESIGN CRITERIA

- 1.5.1. Pumps design and manufacturer shall conform to Hydraulic Institute Standards.
- 1.5.2. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.

- 1.5.3. Head capacity curves shall slope up to maximum head at shut off. Curves shall be relatively flat for closed systems. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable operation. Select pumps for open systems so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA).
- 1.5.4. Pump Driver: Furnish with pump. Size shall be non overloading at any point on the head capacity curve, including in a parallel or series pumping installation with one pump in operation.
- 1.5.5. Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.
- 1.5.6. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency.
- 1.5.7. Test all pumps before shipment. The manufacturer shall certify all pump ratings.
- 1.5.8. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.
- 1.5.9. Allowable Vibration Tolerance for Pump Units: Section: 23 05 48 Vibration and Seismic Controls for HVAC.

1.6. SUBMITTALS

- 1.6.1. Submit in accordance with Section: 01 33 23 Shop Drawings, Product Data, and Samples.
- 1.6.2. Manufacturer's Literature and Data:
 - 1.6.2.1. Pumps and accessories.
 - 1.6.2.2. Motors and drives.
 - 1.6.2.3. Variable speed motor controllers.
 - 1.6.2.4. Manufacturer's installation, maintenance and operating instructions, in accordance with **Section: 23 05 00 Common Work Results for HVAC.**
 - 1.6.2.5. Characteristic Curves: Head capacity, efficiency capacity, brake horsepower capacity, and NPSHR capacity for each pump and for combined pumps in parallel or series service. Identify pump and show fluid pumped, specific gravity, pump speed and curves plotted from zero flow to maximum for the impeller being furnished and at least the maximum diameter impeller that can be used with the casing.

1.7. CLOSEOUT SUBMITTALS

- 1.7.1. Operation and Maintenance Data: Supply maintenance data including marked performance curves for each hydronic pump for incorporation into manual

1.8. APPLICABLE PUBLICATIONS

- 1.8.1. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only:

- 1.8.2. American National Standards Institute (ANSI):

- 1.8.2.1. ANSI B15.1-00(R2008) Safety Standard for Mechanical Power Transmission Apparatus
- 1.8.2.2. ANSI B16.1 05 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800

- 1.8.3. American Society for Testing and Materials (ASTM):

- 1.8.3.1. A48-03 (2008) Standard Specification for Gray Iron Castings
- 1.8.3.2. B62 2009 Standard Specification for Composition Bronze or Ounce Metal Castings
- 1.8.3.3. Maintenance and Operating Manuals in accordance with Section: 01 33 23 Shop Drawings, Product Data, and Samples.

1.9. DEFINITIONS

- 1.9.1. Capacity: Liters per second (L/s) (Gallons per minute (GPM) of the fluid pumped.
- 1.9.2. Head: Total dynamic head in kPa (feet) of the fluid pumped.
- 1.9.3. Flat head capacity curve: Where the shutoff head is less than 1.16 times the head at the best efficiency point.

1.10. DELIVERY STORAGE AND HANDLING

- 1.10.1. Delivery and Requirements:

- 1.10.1.1. Deliver materials and components in manufacturer's original packaging with identification labels intact and in sizes to suit project.
- 1.10.1.2. Include manufacturer's name, job number, pump location, and pump model and series numbers on identification labels.
- 1.10.1.3. Storage and Handling Requirements: Store materials off ground and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer. Storage must be weather tight, rain proof, and dust proof.

- 1.10.1.4. Exercise care to avoid damage during unloading and storing.
- 1.10.1.5. Leave pump port protection plates in place until pumps are ready to connect to piping.
- 1.10.1.6. Do not place cable slings around pump shaft or integrated control enclosure.
- 1.10.1.7. Once installed the contractor must keep a dust proof cover over the drive, motor, and integral controller.

1.11. SPARE MATERIALS

- 1.11.1.1. Furnish one spare seal and casing gasket for each pump to the Client Representative.

1.12. WARRANTY

- 1.12.1. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

1.13. STANDARDS OF ACCEPTANCE

- 1.13.1. Armstrong
- 1.13.2. Taco
- 1.13.3. Bell & Gossett
- 1.13.4. Grundfoss

PART 2 - PRODUCTS

2.1. GENERAL PUMP REQUIREMENTS:

- 2.1.1. Unless noted otherwise, provide pumps meeting these general requirements.
- 2.1.2. Suitable for the service, rated for the temperature and pressure indicated. When not indicated, pump and pump seals shall be rated for not less than 1,200 kPa (175 psig) working pressure and 107 deg.C (225 degrees F) continuous water temperature. Provide pumps with capacities and performance as scheduled on the Drawings.
- 2.1.3. Flanged pumps shall have suction and discharge taps in flanges, and drain and vent taps in the volute. Piping connections shall be flanged for connection sizes 65 mm (2½ inches) and larger.
- 2.1.4. Pumps shall have statically and dynamically balanced impeller, with a constantly dropping head curve from shutoff to cutoff, and shall not overload their respective motors on any point throughout the head capacity curve. Key and lock impeller to shaft.

- 2.1.5. Motors shall be factory coupled to pump and with rpm, voltage and HP as scheduled. Single phase motors shall have built-in overload protection.
- 2.1.6. Where flexible coupling is specified, coupling shall be EPDM, center dropout type, capable of absorbing torsional vibration and shaft misalignment, complete with ANSI B15.1/OSHA 1910.219 coupling guard.
- 2.1.7. Pumps for domestic water systems shall be lead free (less than 0.25 percent lead by weight in all wetted surfaces) all bronze or stainless steel construction.
- 2.1.8. Pump seals shall be unaffected by chloramines.
- 2.1.9. Pumps used for glycol shall have seals rated for glycol service.
- 2.1.10. Pump selection:
 - 2.1.10.1. Select pumps so an impeller/volute is sized to accommodate 10 percent more head than at duty point, unless noted otherwise on pump schedule.
 - 2.1.10.2. Select pump no greater than 85 percent of end of curve flow.
 - 2.1.10.3. Select pump at the point of best efficiency for a given impeller-casing combination. Deviations shall be within 3 percent of maximum efficiency point on the increasing capacity side of the maximum efficiency point.
 - 2.1.10.4. Pumps inlet/outlet connections shall not be less than 1 pipe size smaller than the main pipe connecting to the pumps.
 - 2.1.10.5. Maximum Pump Suction/Discharge velocities:
 - 2.1.10.5.1. Inline: 3 m/s (10 fps) for both inlet and discharge sizes
 - 2.1.10.5.2. End Suction: 3 m/s (10 fps) for both inlet and discharge sizes
 - 2.1.10.6. Balance pumps per ANSI / Hydraulic Institute procedures.
 - 2.1.10.7. For pumps to be applied in variable speed applications, balance and test to assure the vibration limit does not exceed 3.3 mm/s (0.13 inches/sec) at any pump speed. Pumps may be field tested after installation by an independent testing agency. Any pump found to exceed the specified vibration limits shall be corrected to perform within those limits without cost to the Client.

2.2. VERTICAL IN-LINE CLOSE COUPLED PUMPS.

- 2.2.1. Refer to the schedule for pump flows and heads and motor speed, efficiency, enclosure and power requirements.
- 2.2.2. Pump casing shall be cast iron, suitable for 175 psig (12 bar) working pressure at 140°F (60°C). The casing shall be hydrostatically tested to 150% maximum working pressure.
- 2.2.3. The casing shall be radially split to allow removal of the rotating element without disturbing the pipe connections. The casing shall be provided with npt threaded companion flanges, for the appropriate pump size, with gaskets and hardware.

- 2.2.4. Pump impeller shall be fully enclosed type. The impeller shall be keyed and secured to the pump shaft by stainless steel fittings.
- 2.2.5. The pump shaft shall be a stainless steel stub shaft for frame 56 motors. The steel motor shaft shall be enclosed by a bronze shaft sleeve, on other motor frame sizes.
- 2.2.6. Mechanical seal shall be single spring inside type with resin bonded carbon and ceramic faces with buna elastomer single spring inside type with Resin bonded carbon and Silicon carbide faces, with stainless steel spring and hardware.
- 2.2.7. Provide factory installed seal vent line, piped from the seal area to the pump suction connection
- 2.2.8. Motor power requirements shown on the pump schedule are the minimum acceptable and have been sized for continuous operation without exceeding the full load nameplate rating over the entire pump curve, exclusive of service factor.

2.3. IN-LINE CLOSE COUPLED CIRCULATORS

- 2.3.1. The pumps shall be single stage horizontal inline design. The seal shall be serviceable without disturbing the piping connections. The capacities and characteristics shall be as called for in the plans/schedules.
- 2.3.2. Pump shall be constructed of ASTM A48 class 30 cast iron. The pump casing shall be drilled and tapped for gauge ports on both the suction and discharge connections.
- 2.3.3. All casings shall be flanged connections.
- 2.3.4. The impeller shall be ASTM C87500 or C89833 bronze and hydraulically balanced. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted with a holding taper and left handed 431 series stainless steel bolt. The impeller shall be cast by the hydraulically efficient lost foam technique to ensure repeatability of high quality.
- 2.3.5. The pump shall incorporate a dry shaft design to prevent the circulating fluid from contacting the shaft. The pump shaft shall be AISI 1045 carbon steel with field replaceable copper nickel 90-10 shaft sleeve. In order to improve serviceability and reduce the cost of ownership the shaft sleeve must be slip on (press on not allowable) and must be easily replaced in the field.
- 2.3.6. The pump shall be fitted with a single mechanical seal, with EPT elastomers and Carbon/Ceramic faces, rated up to 250°F. The pump shall be coupled to a NEMA 56C face motor with threaded on shaft extension.

2.4. ACCESSORIES

- 2.4.1. Suction Guide

- 2.4.1.1. Suction guide body made of cast iron, ductile iron, or carbon steel, with ansi or din flanges. Same size ports are available with oversized inlet flange to eliminate reducer. Threaded inlet available to "(50mm)
- 2.4.1.2. Guide vanes reduce turbulence, thereby creating optimum flow conditions and minimizing stress on pump components.
- 2.4.1.3. Strainer with V" (3 mm) perforated stainless steel. Star-shaped for added strength and designed to provide large free flow area to reduce pressure drop.
- 2.4.1.4. Removable fine mesh start-up strainer, furnished as a standard item, helps prevent mechanical seal or instrument damage during initial run period.
- 2.4.1.5. Provide magnet to help eliminate free floating metallic particles from system.
- 2.4.1.6. Removable cover, with O-ring, enables easy access to strainer.
- 2.4.1.7. Additional features:
 - 2.4.1.7.1. Flow Indicator Scale
 - 2.4.1.7.2. Anti-rotation Lugs
 - 2.4.1.7.3. Flow Indicator Scale
 - 2.4.1.7.4. Bonnet O-Ring
 - 2.4.1.7.5. Stainless
 - 2.4.1.7.6. Steel Stem
 - 2.4.1.7.7. Seat Holder
 - 2.4.1.7.8. Bronze Disc
 - 2.4.1.7.9. Stainless Steel Spring
 - 2.4.1.7.10. Seat Gasket Pressure/Temperature
 - 2.4.1.7.11. Measurement Ports Drain Connection (on opposite side)
- 2.4.2. Flo-Trex Valve
 - 2.4.2.1. Each valve is to incorporate the following three functions in one body:
 - 2.4.2.1.1. Tight shut-off
 - 2.4.2.1.2. Spring-closure type silent non-slam check
 - 2.4.2.1.3. Effective throttling design capability
 - 2.4.2.2. The throttling function should not be used in variable speed applications and is to be used only to alleviate any noise, vibration or cavitation where a speed reduction to design flow solution will not eliminate these symptoms
 - 2.4.2.3. The body shall have (2) 1/4" NPT connections on each side of the valve seat. One connection on each size shall have brass pressure and temperature metering ports, with Nordel check valves and gasketed caps. The other connection on each side shall be supplied with brass drain plugs. Metering ports are to be interchangeable with drain plugs to allow for measurement flexibility when installed in tight locations. The valve disk shall be bronze plug & disc type with high impact engineered resin seat to ensure tight shut-off and silent check operation.

- 2.4.2.4. The valve stem shall be stainless steel with flat surfaces provided for adjustment with open-end wrench.
- 2.4.2.5. The valve shall be selected and installed in accordance with the manufacturer's instructions and be suitable for the pressure and temperature specified.
- 2.4.2.6. Insulation - fluids colder than 18°C
 - 2.4.2.6.1. Each valve shall be furnished with a pre-formed removable PVC insulation jacket to meet ASTM D1784 Class 14253-C, MEA #7-87, ASTM-E-84 and ASTM136 with a flame spread rating of 25 or less and a smoke development rating of 50 or less. There will be provided sufficient mineral fiberglass insulation to meet ASHRAE 90.1-1989 specifications in operating conditions with maximum Fluid Design Operating Temperature Range of 141°F-200°F (60°C-93°C) and Mean Rating Temperature of 125°F (52°C).
- 2.4.2.7. Valve seat can be changed in the field without use of special tools.
- 2.4.2.8. Flow indicator scale includes valve stem, grooved rings and positioning sleeve. The quarter turn graduations on the sleeve, with the scribe line on the stem provide for approximate flow measurement.

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. Follow manufacturer's written instructions for pump mounting and start up. Access/Service space around pumps shall not be less than minimum space recommended by pumps manufacturer.
- 3.1.2. Ensure that pump is pipe-mounted and free to float with any movement, expansion and contraction of piping system.
- 3.1.3. Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to drawings and manufacturer's installation instructions for details.
- 3.1.4. Provide vibration isolation between the pumps and pipes, and between the pumps and the concrete curbs.
- 3.1.5. Support pump using floor mounted saddle as required. i. For vertical in-line pumps supported from structure, ensure no pipe strain is imposed on pump flanges
- 3.1.6. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instructions and all applicable codes.
- 3.1.7. Control wiring for shall be the dual responsibility of the electrical and BAS contractors. All wiring shall be performed per manufacturer's instructions and all applicable codes.

- 3.1.8. Provide drains for bases and seals for base mounted pumps, piped to and discharging into floor drains.
- 3.1.9. Coordinate location of thermometer and pressure gauges as per Section: 23 21 13 Hydronic Piping.

3.2. ACCESSORIES

- 3.2.1. Install a suction guide upstream of each floor mounted vertical in-line pump unless specified or shown otherwise on the drawings. The mechanical contractor shall inspect the strainer prior to activating the pump and, further, shall remove the fine mesh start-up strainer after a short running period. (24 hours maximum). Space shall be provided for removal of the strainer and connection of a blow-down valve.
- 3.2.2. Install a strainer upstream of each floor mounted horizontal inlet/vertical discharge pump and upstream of each vertical in-line close coupled circulator pumps. The mechanical contractor shall inspect the strainer prior to activating the pump and, further, shall remove the fine mesh start-up strainer after a short running period. (24 hours maximum). Space shall be provided for removal of the strainer and connection of a blow-down valve.
- 3.2.3. Install a triple duty valve on the discharge of each vertical in-line pump or horizontal inlet/vertical discharge floor mounted pump, unless specified or shown otherwise on the drawings. Angle style or straight in-line arrangement, as suitable to the pump type and local conditions.
- 3.2.4. Install a manual circuit balancing valve on the discharge of each vertical in-line close coupled circulator pumps.
- 3.2.5. Install a check valve on the discharge of each pump where more than 1 pump discharges into a common header.
- 3.2.6. Contractor to provide and install one pressure gauge, piped to pump suction, pump discharge and strainer inlet (suction guide). Pressure gauge tapings with necessary isolating valves to enable differential pressure reading across pump and strainer to be taken.
- 3.2.7. Where applicable, the motors shall be rated for variable speed duty. Contractor shall cover motor during construction and have area clean of construction debris before starting the motor.

3.3. START UP

- 3.3.1. Verify that the piping system has been flushed, cleaned and filled.
- 3.3.2. Lubricate pumps before start-up.

- 3.3.3. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.
- 3.3.4. Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.
- 3.3.5. Sensor-less pumps: final adjustments and start-up: by manufacturer's representatives together with the hydronic balancer and the BAS vendor.
- 3.3.6. Field modifications to the bearings and or impeller (including trimming) are not permitted. If the pump does not meet the specified vibration tolerance send the pump back to the manufacturer for a replacement pump. All modifications to the pump shall be performed at the factory.
- 3.3.7. Ensure the disposable strainer is free of debris prior to testing and balancing of the hydronic system.
- 3.3.8. After several days of operation, replace the disposable start up strainer with a regular strainer in the suction diffuser.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. GENERAL	2
1.2. REFERENCE STANDARDS	2
1.3. SHOP DRAWINGS AND PRODUCT DATA	2
1.4. MAINTENANCE DATA AND MANUALS	2
1.5. CAPACITY AND PERFORMANCE	2
1.6. STANDARD OF ACCEPTANCE	2
PART 2 - PRODUCTS	3
2.1. GENERAL	3
2.2. EQUIPMENT CONSTRUCTION	3
PART 3 - EXECUTION	5
3.1. INSTALLATION	5
3.2. HEAT PUMP PIPING SYSTEM FLUSHING PROCEDURE	6
3.3. HEAT PUMP START-UP	6

PART 1 - GENERAL

1.1. GENERAL

- 1.1.1. This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section: 23 05 00 Common Work Results for HVAC of the specification.

1.2. REFERENCE STANDARDS

- 1.2.1. The factory assembled heat pumps units shall conform to the requirements outlined ASHRAE 90.1.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit shop drawings and product data in accordance with the contract documents and Section: 01 33 23 Shop Drawings, Product Data, and Samples.
- 1.3.2. Indicate the following: fan, fan curve, motor drive, filters c/w efficiency, wiring diagrams, control diagrams, access doors, dampers, plus all performance data, cooling performance, heating performance, fan performance.
- 1.3.3. Sound power data for all fans coil units to be provided. Sound power data shall include sound power data for supply fan discharge and sound power levels radiated from the unit.

1.4. MAINTENANCE DATA AND MANUALS

- 1.4.1. Provide maintenance data for incorporation into maintenance manual as indicated in the contract documents and Section: 23 05 00 Common Work Results for HVAC.

1.5. CAPACITY AND PERFORMANCE

- 1.5.1. As indicated on the drawings and equipment schedules

1.6. STANDARD OF ACCEPTANCE

- 1.6.1. Water Furnace NXW Series
- 1.6.2.
- 1.6.3. In addition to all requirements stated in the Documents for Alternate equipment, if the Contractor carry alternate manufacturer for HPs, he will be fully responsible for any changes and modifications to the power supply and the existing services located above the ceiling in order to properly install the equipment. The alternate equipment to be within the size and weight of the specified units and have same location for piping connections.

PART 2 - PRODUCTS

2.1. GENERAL

- 2.1.1. Single package water source heat pump with reverse cycle valve.
- 2.1.2. The unit shall be listed by a nationally recognized testing laboratory (NRTL), such as UL, CSA, TUV, or ETL. The unit shall be rated in accordance with applicable standards of the Air Conditioning, Heating, and Refrigeration Institute / International Standards Organization (AHRI/ISO) and/or Canadian Standards Association (CSA).
- 2.1.3. Capacity and performance: as indicated on the equipment schedules

2.2. EQUIPMENT CONSTRUCTION

- 2.2.1. Each unit shall be constructed with a heavy duty standalone frame, and shall be enclosed in a sheet metal cabinet. Frame shall be constructed of powder coated galvanized sheet metal of minimum 11 gauge.
- 2.2.2. Cabinet shall be constructed of steel treated with polyester paints RAL 9003. Design and construction of cabinet shall be such that it is rigid and passes the CSA/UL Loading Test requirements (200 lb roof test and 25 lb guard test).
- 2.2.3. All panels shall be lined with minimum 1 inch [25.4 mm] thick acoustic type glass fiber insulation. All insulation shall meet the fire retardant provisions of NFPA 90A.
- 2.2.4. The enclosure must have access panels for serviceability of the compressors, heat exchangers and refrigerant expansion devices compartments.
- 2.2.5. The unit shall be completely factory pre-wired and shall require a single point electrical connection. The electrical box shall have separate holes and knockouts for entrance of line voltage and low voltage control wiring. All factory-installed wiring passing through factory knockouts and openings shall be protected from sheet metal edges at openings by plastic grommets.
- 2.2.6. All units are equipped with scroll compressors with steam injection and brazed plate heat exchangers. Compressors shall be specified for heat pump duty with internal isolation

consisting of rubber vibration isolators. Compressor motors shall have internal overload protection. Compressor shall be mechanically isolated from rest of refrigerant circuit by suction and discharge vibration absorbers. Compressor shall be equipped with a crankcase/sump heater to prevent liquid refrigerant migration during the off cycle and subsequent flooded starts.

- 2.2.7. All units shall contain multiple separate sealed refrigerant circuits, each containing a hermetic motor scroll compressor, one electronic expansion valve, factory installed high and low pressure sensors, service ports, solid core filter-dryer, sight glass, reversing valve (for reversing units), and suction accumulator. Refrigerant circuits shall share true dual circuit brazed plate heat exchangers.
- 2.2.8. The water to refrigerant heat exchangers shall be of a stainless steel brazed plate design, designed and certified for 650 psig [4480 kPa] working pressure on the refrigerant side and 650 psig [4480 kPa] on the water side. Heat exchangers shall be insulated over all of their outside surface with minimum 3/8" thick closed cell insulation.
- 2.2.9. All internal water and refrigerant piping shall be insulated with minimum 3/8" thick closed cell insulation.
- 2.2.10. The electronic expansion valves shall be of stepper-motor rather than pulsing type, and shall provide proper superheat control over the unit's operating range with minimal deviation from superheat setpoint. The valves shall be controlled by electronic superheat controller(s) which provide operator-adjustable superheat and real-time LED/LCD display of current superheat. Superheat shall be determined through the suction pressure-temperature method. Externally mounted pressure controlled water regulating flow valves or thermostatic expansion valves (TXV's) in place of electronic expansion valves are not acceptable.
- 2.2.11. The suction accumulators shall be insulated with minimum 3/8" thick closed cell insulation to prevent condensation. The accumulator's internal oil return port shall be sized properly for the unit's operating range.
- 2.2.12. Electrical controls and safety devices shall be factory wired and mounted within the unit. Controls shall include 24 volt alternating current (24VAC) activated compressor contactors, reversing valves, and 24VAC/100VA transformer with built in circuit breaker or fused on both primary and secondary sides.
- 2.2.13. Safeties:
 - 2.2.13.1. Anti-short cycle time delay on compressor operation. Time delay shall be a minimum of 5 minutes. An override shall be provided to disable this delay for unit commissioning and testing purposes.
 - 2.2.13.2. Random compressor start delay of 0-120 seconds on unit power up to facilitate

starting multiple units after a power failure.

2.2.13.3. Flow switch on ground source loop, and on user loop.

2.2.13.4. Compressor shutdown for high or low refrigerant pressures, low flow conditions and for phase protection faults.

2.2.13.5. Automatic intelligent reset: unit shall automatically restart 5 minutes after trip if the fault has cleared. Should a fault reoccur 3 times sequentially then permanent lockout shall occur, requiring cycling of the power to the unit in order to reset.

2.2.13.6. Double safety valve with exchange cock, both on the high and low pressure branches

2.2.14. Building Automation And Sequencing

2.2.14.1. The equipment shall be fully compatible with the existing building automation system, manufactured by Johnson Controls.

2.2.14.2. Controller shall include Microprocessor adjustment, with keyboard and LCD display for easy access on the unit.

2.2.14.3.

2.2.14.4. At the minimum, the heat pump and the BAS shall interface to allow the following inputs/outputs:

2.2.14.4.1. Enable/disable of the unit and time of day/time of year scheduling

2.2.14.4.2. Selecting the user side leaving air temperature

2.2.14.4.3. Feedback of: equipment status, compressors status.

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Install unit in accordance with manufacturer's instructions and as indicated. Maintain service clearances as required by the manufacturer's literature.

3.1.2. Start-up and adjustment: by manufacturer's representative.

3.1.3. Supply all control devices, sensors, relays and wiring required to make the equipment fully functional in accordance with the sequence of operation indicated in Section: 23 09 00 Instrumentation and Control for HVAC. Assemble all components that require field installation. Include all step-down transformers, relays and other devices, as required.

3.1.4. Mount unit on vibration isolation neoprene pads.

3.1.5. Installing contractor to:

- 3.1.5.1. Install per manufacturer's requirements, shop drawings, and contract documents.
- 3.1.5.2. Adjust chiller alignment on foundations, or subbases as called for on drawings.
- 3.1.5.3. Arrange piping to allow for dismantling to permit components removal.
- 3.1.5.4. Coordinate electrical installation with electrical contractor.
- 3.1.5.5. Coordinate controls with control contractor.
- 3.1.5.6. Provide all material required for a fully operational and functional heat pump

3.2. HEAT PUMP PIPING SYSTEM FLUSHING PROCEDURE

- 3.2.1. Before connecting the chiller to the condenser and chilled water loop, the piping loops shall be flushed with a detergent and hot water (110-130° F) mixture to remove previously accumulated dirt and other organics. In existing piping systems with heavy encrustation of inorganic materials, consult a water treatment specialist for proper passivation and/or removal of these contaminants.
- 3.2.2. During the flushing, a 30 mesh (max.) Y-strainers (or acceptable equivalent) shall be temporarily placed in each loop (source and user) and examined periodically as necessary to remove collected residue. The flushing process shall take no less than 6 hours or until the strainers when examined after each flushing are clean. Old systems with heavy encrustation shall be flushed for a minimum of 24 hours and may take as long as 48 hours before the filters run clean. Detergent and acid concentrations shall be used in strict accordance with the respective chemical manufacturer's instructions. After flushing with the detergent and/or dilute acid concentrations the system loop shall be purged with clean water for at least one hour to ensure that all residual cleaning chemicals have been flushed out.
- 3.2.3. Prior to supplying water/glycol to the heat pump the Water Treatment Specification shall be consulted for requirements regarding the water quality during the equipment operation. The appropriate heat pump manufacturer's service literature shall be available to the operator and/or service contractor and consulted for guidelines concerning preventative maintenance and off-season shutdown procedures.

3.3. HEAT PUMP START-UP

- 3.3.1. Factory Start-Up Services: Provide for as long a time as is necessary to ensure proper operation of the unit, but in no case for less than two full working days. During the period

of start-up, the start-up technician shall instruct the Client's representative in proper care and operation of the unit.

TABLE OF CONTENTS

PART 1 - GENERAL	3
1.1. DESCRIPTION	3
1.2. MINIMUM REQUIREMENTS.....	3
1.3. TEST STANDARDS.....	3
1.4. DEFINITIONS	3
1.5. QUALIFICATIONS (PRODUCTS AND SERVICES)	5
1.6. APPLICABLE PUBLICATIONS, CODES AND STANDARDS	5
1.7. MANUFACTURED PRODUCTS	6
1.8. VARIATIONS FROM CONTRACT REQUIREMENTS	6
1.9. MATERIALS AND EQUIPMENT PROTECTION	7
1.10. WORK PERFORMANCE.....	7
1.11. COORDINATION AND INTERFERENCE DRAWINGS	8
1.12. EQUIPMENT INSTALLATION AND REQUIREMENTS	8
1.13. EQUIPMENT IDENTIFICATION.....	9
1.14. SUBMITTALS	9
1.15. RECORD DRAWINGS	11
1.16. ACCEPTANCE CHECKS AND TESTS	12
1.17. CODES, PERMITS AND INSPECTIONS	12
1.18. WARRANTY	12
1.19. INSTRUCTION.....	12
PART 2 - PRODUCTS	13
2.1. MATERIALS AND EQUIPMENT	13
2.2. EQUIVALENTS AND ALTERNATES.....	13
2.3. MATERIAL SUBSTITUTION	14
2.4. WARNING SIGNS.....	15
2.5. FINISHES.....	15
2.6. CAN/CSA/NEMA RATING	15
PART 3 - EXECUTION	15
3.1. INSTALLATION.....	15
3.2. SITE SERVICES	16

3.3.	CONTRACTOR'S SHOP	16
3.4.	TEMPORARY SERVICES	17
3.5.	ACCESS TO ELECTRICAL EQUIPMENT, JUNCTION BOXES AND PULL BOXES.....	17
3.6.	NAMEPLATES	17
3.7.	LOCK OFF TABS	17
3.8.	FIRESTOPPING	17
3.9.	BASES AND SUPPORTS.....	18
3.10.	INSERTS, SLEEVES AND CURBS	18
3.11.	CUT PATCH AND MAKE GOOD.....	19
3.12.	REMOVALS AND DEMOLITION	20
3.13.	REMOVED MATERIAL.....	21
3.14.	NUMBER AND LOCATION OF OUTLETS	21
3.15.	MOUNTING HEIGHTS.....	22
3.16.	MECHANICAL AND ELECTRICAL CO-ORDINATION OF RESPONSIBILITIES	22
3.17.	FLASHING.....	24
3.18.	SYSTEM STARTUP	24
3.19.	CLEANING	24

PART 1 - GENERAL**1.1. DESCRIPTION**

- 1.1.1. This section applies to all sections of Division 26 - Electrical.
- 1.1.2. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.
- 1.1.3. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.
- 1.1.4. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.2. MINIMUM REQUIREMENTS

- 1.2.1. Canadian Electrical Safety Code, (CESC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- 1.2.2. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3. TEST STANDARDS

- 1.3.1. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

1.4. DEFINITIONS

- 1.4.1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
- 1.4.2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by who's labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
- 1.4.3. "Concealed" means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls, or partitions. Wiring, raceways, and electrical boxes for all new or relocated devices shall be concealed.
- 1.4.4. "Exposed" means work normally visible to any person standing, sitting, or otherwise using the occupied space, including work in equipment rooms, tunnels, and similar spaces.
- 1.4.5. "Provide" (and all tenses) means supply and install for a complete, operational, and code-compliant system, including all devices/equipment as specified complete with wiring, raceways (conduit), electrical boxes, and all other accessories required for a complete, operational, and code compliant installation.
- 1.4.6. "Install" (and all tenses) means secure in position, connect as specified, test, and verify.
- 1.4.7. "Supply" means to supply all devices/equipment to the responsible trade.
- 1.4.8. "Remove" means to isolate, disconnect, disassemble, remove, and dispose of all devices, equipment, wiring, raceways, and connections to other equipment all the way to the main source. Patch and make good all surfaces affected by the removal. Include for all disposal costs in the tender price.
- 1.4.9. The term "approved", "approval", etc., shall be understood to mean approved by authorities having jurisdiction as conforming to Codes, Standards, By-laws, etc.
- 1.4.10. The term "accessible" shall be understood to mean readily accessible by a person using necessary tools but without cutting or breaking out material.
- 1.4.11. The term "listed" shall be understood to mean that the materials or equipment have been tested in accordance with applicable standards, and have been approved and listed for their intended use by a testing company approved by the Authorities having jurisdiction.

1.4.12. The term "listed" shall be understood to mean that the materials or equipment have been tested in accordance with applicable standards, and have been approved and listed for their intended use by a testing company approved by the Authorities having jurisdiction

1.4.13. Where used, wordings such as "approved, to approval, as directed, permitted, permission, accepted, acceptance", shall mean: approved, directed, permitted, accepted, by an authorized representative of the Owner. and Install: material, equipment and labor shall be provided as required to make the equipment or system fully operational. Include all required wiring, conduit and other electrical devices as required, whether shown on the drawings, specified herein or not.

1.4.14. Certified: Materials and equipment which:

1.4.14.1. Have been tested and found to meet nationally recognized standards or to be safe for use in a specified manner.

1.4.14.2. Bear a label, tag, or other record of certification.

1.5. QUALIFICATIONS (PRODUCTS AND SERVICES)

1.5.1. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

1.5.2. Product Qualification:

1.5.2.1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.

1.5.2.2. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.6. APPLICABLE PUBLICATIONS, CODES AND STANDARDS

1.6.1. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.

1.6.2. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6.3. Publications:

- 1.6.3.1. CAN/CSA C22.1-015, Canadian Electrical Code Part 1 (23rd Edition), Safety Standard for Electrical Installations.
- 1.6.3.2. Ontario Electrical Safety Code 26th Edition / 2015 or later.
- 1.6.3.3. CAN3-C235-83 (R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
- 1.6.3.4. National Building Code of Canada.
- 1.6.3.5. National Fire Code of Canada.
- 1.6.3.6. Ontario Building Code 2012.
- 1.6.3.7. National Fire Protection Code NFPA-70

1.7. MANUFACTURED PRODUCTS

- 1.7.1. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available.
- 1.7.2. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
- 1.7.3. Equipment Assemblies and Components:
 - 1.7.3.1. Components of an assembled unit need not be products of the same manufacturer.
 - 1.7.3.2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
- 1.7.4. Components shall be compatible with each other and with the total assembly for the intended service.
- 1.7.5. Constituent parts which are similar shall be the product of a single manufacturer.
- 1.7.6. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.
- 1.7.7. When Factory Testing Is Specified:
 - 1.7.7.1. The Board shall have the option of witnessing factory tests. The Contractor shall notify the Board a minimum of 15 working days prior to the manufacturer's performing the factory tests.
 - 1.7.7.2. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Board to witness re-testing.

1.8. VARIATIONS FROM CONTRACT REQUIREMENTS

- 1.8.1. Where the Board or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.9. MATERIALS AND EQUIPMENT PROTECTION

- 1.9.1. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
- 1.9.2. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
- 1.9.3. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
- 1.9.4. Damaged equipment shall be repaired or replaced, as determined by the Consultant.
- 1.9.5. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
- 1.9.6. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.10. WORK PERFORMANCE

- 1.10.1. All electrical work shall comply with the requirements of CESC, NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.
- 1.10.2. Job site safety and worker safety is the responsibility of the Contractor.
- 1.10.3. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
- 1.10.4. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
- 1.10.5. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Consultant

1.10.6. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility.

1.10.7. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions.

1.10.8. Coordinate location of equipment and conduit with other trades to minimize interference.

1.11. COORDINATION AND INTERFERENCE DRAWINGS

1.11.1. Provide information and cooperate with the General/Mechanical Contractor for the preparation of interference and coordination drawings.

1.11.2. Interference and coordination drawings to be provided in order to make clear the Work intended or to show how it affects other trades.

1.11.3. interference and coordination drawings to be provided for:

- 1.11.3.1. Mechanical, Electrical, Communications Rooms
- 1.11.3.2. Service corridors and tunnels
- 1.11.3.3. Corridor, lobbies and all public spaces
- 1.11.3.4. Crawl spaces
- 1.11.3.5. Attic spaces
- 1.11.3.6. Underground Trenches
- 1.11.3.7. Raised floor spaces

1.12. EQUIPMENT INSTALLATION AND REQUIREMENTS

1.12.1. Equipment location shall be as close as practical to locations shown on the drawings.

1.12.2. Working clearances shall not be less than specified in the CEC.

1.12.3. Inaccessible Equipment:

- 1.12.3.1. Where the Consultant determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Board.
- 1.12.3.2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.12.4. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility

company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.13. EQUIPMENT IDENTIFICATION

- 1.13.1. In addition to the requirements of the CEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.
- 1.13.2. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.
- 1.13.3. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm²), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

1.14. SUBMITTALS

- 1.14.1. All submittals shall include copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Board to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.
- 1.14.2. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
- 1.14.3. The Consultant's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

1.14.4. The submittals shall include the following:

- 1.14.4.1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
- 1.14.4.2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
- 1.14.4.3. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

1.14.5. Maintenance and Operation Manuals:

- 1.14.5.1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
- 1.14.5.2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
- 1.14.5.3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.

1.14.6. The manuals shall include:

- 1.14.6.1. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
- 1.14.6.2. A control sequence describing start-up, operation, and shutdown.
- 1.14.6.3. Description of the function of each principal item of equipment.
- 1.14.6.4. Installation instructions.
- 1.14.6.5. Safety precautions for operation and maintenance.
- 1.14.6.6. Diagrams and illustrations.
- 1.14.6.7. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
- 1.14.6.8. Performance data.
- 1.14.6.9. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.

- 1.14.6.10. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- 1.14.6.11. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

1.15. RECORD DRAWINGS

- 1.15.1. The Consultant will provide to the Electrical Contractor one set of AutoCad computer files and one set of white prints of all drawings relating to the work of this contract, for the purpose of preparing record drawings. As the job progresses, mark up the white prints to accurately indicate installed work, i.e. location and elevations, etc. On completion of the work, the Electrical Contractor to transfer the information neatly onto the computer files based on AutoCad 2007 or higher, and submit the electronic files and one set of prints for review and comment. Correct the files as directed by the Consultant and hand these over to the Board, together with a set of white prints, on completion.
- 1.15.2. Record, as the job progresses, all approved changes and deviations made to any work shown on the original contract drawings whether by addenda, requested changes, job instructions, and changes due to job conditions.
- 1.15.3. Indicate on the drawings all conduits, pull boxes, junction boxes, empty conduits, concealed main and sub-feeder conduits and any other equipment not clearly in view, with exact dimensions for future reference. Tie dimensions by measurement to existing topographical features, and include changes in directions as well as at least three points on straight runs of conduits on raceways.
- 1.15.4. All conduits in slabs, under slab and direct buried are to be shown on the Record drawings.
- 1.15.5. Record drawings to be kept up to date and be available for checking at any time by Boards and Consultant. Progress draws will not be reviewed unless the record drawing set is up to date.
- 1.15.6. All equipment schedules, panel schedules, system schedules, riser diagrams, details, etc. to be updated to reflect the as installed condition and included as part of the record drawing submission.
- 1.15.7. Provide a schedule indicating the protective device trip setting of all Air Circuit Breakers and Electronic Solid State Circuit Breakers which are reflected on each of the Power Distribution Single Line Riser Diagram drawings. The protective device trip settings that are to be listed in the schedule are to be those which are based upon the final reviewed and accepted version of the short circuit and protection and coordination as well as the arc flash study.

1.15.8. Branch circuiting, lighting zoning, switching, etc. methodology to be the same as that indicated on the electrical contract documents that are issued for construction.

1.15.9. Electrical record drawings to be submitted in both AutoCad and PDF format.

1.15.10. Record drawings will not be reviewed for acceptance until project substantial completion has been issued.

1.16. ACCEPTANCE CHECKS AND TESTS

1.16.1. The Contractor shall furnish the instruments, materials, and labor for tests.

1.16.2. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Board.

1.16.3. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Board.

1.17. CODES, PERMITS AND INSPECTIONS

1.17.1. All work to meet or exceed the latest requirements of the Codes and Standards as listed in PART 1 of these specifications, supplements, local inspection bulletins and all Authorities Having Jurisdiction.

1.17.2. Arrange for inspection of all work and pay all fees in this regard. On completion of the work, deliver the final unconditional certificate of approval of the Electrical Safety Authority (ESA).

1.17.3. It is hereby agreed that all requirements meet CAN/CSA requirements and a complete installation in accordance with these requirements to be provided.

1.17.4. Keep a permanent record of each inspection made by the Electrical Safety Authority showing the date, inspector's name, scope of the inspection and statement of special decisions or permissions granted. Make these records available to the Consultant at any time, and turn them over at completion of the work.

1.18. WARRANTY

1.18.1. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Board's representative.

1.19. INSTRUCTION

- 1.19.1. Instruction to designated Board personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- 1.19.2. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.
- 1.19.3. A training schedule shall be developed and submitted by the Contractor and approved by the Consultant at least 15 days prior to the planned training.

PART 2 - PRODUCTS

2.1. MATERIALS AND EQUIPMENT

- 2.1.1. All materials and equipment to be new and free from defects.
- 2.1.2. All material and equipment to be CAN/CSA certified. Where CAN/CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- 2.1.3. Where materials, equipment, apparatus, or other products are specified by the manufacturer, brand name, type or catalogue number, such designation is to establish the standards of desired quality, style or dimensions and to be the basis of the Bid. Furnish materials so specified under this Contract unless changed by mutual agreement. Where two or more designations are listed, the Electrical Contractor to choose one of those listed.
- 2.1.4. Where the use of equivalent, alternate or substitute equipment alters the design or space requirements indicated on the plans, the Electrical Contractor for this contract to include all items of cost for the revised design and construction, including the cost of all the other trades involved.
- 2.1.5. Acceptance of the proposed equivalents, alternates or substitutions to be subject to the review by the Consultant, and if requested, the Electrical Contractor to submit for inspection, samples of both the specified and the proposed alternate items.
- 2.1.6. In all cases where the use of equivalents, alternates or substitutions is permitted, the Electrical Contractor to bear any extra costs of evaluating the quality of materials and the equipment to be installed.

2.2. EQUIVALENTS AND ALTERNATES

- 2.2.1. Should the Electrical Contractor propose to furnish material and equipment other than those specified, he is to apply in writing to the Consultant for approval of equivalents at least ten working days prior to the closing of Bids, submitting with his request for approval, complete descriptive and technical data on the item or items he proposes to furnish. Approval for changes in the base bid specifications will be considered only upon the individual requests of the Electrical Contractor. No blanket approval for equipment will be given to suppliers, distributors or contractors.
- 2.2.2. Unless requests for changes in base bid specifications are received and approved prior to the opening of the bids, as defined above, the Electrical Contractor will be held to furnish all specified items under his base bid. After the Contract is awarded, changes in specifications will be made only as defined in the Article dealing with Material Substitution.
- 2.2.3. Replace unspecified materials or rejected equivalents and alternates built into the work with specified or accepted materials at no additional cost to the Owner.
- 2.2.4. If any material or equipment being considered for substitution involves additional design, architectural or engineering fees or other costs in checking whether or not the substitute material or equipment is suitable for the project, such fees or costs to be paid for by the Electrical Contractor. A minimum of five hundred dollars (\$500.00) to be applied to each piece of device or equipment requested for review. There is no guarantee that the reviewed product will be accepted by the Board or the reviewing Consultant.

2.3. MATERIAL SUBSTITUTION

- 2.3.1. After award of the Contract, requests for substitution of materials of makes other than those specifically named in the Contract Documents may be considered by the Consultant subject to the following:
 - 2.3.1.1. The specified material cannot be delivered to the job in time to complete the work in proper sequence to work of other trades, due to conditions beyond the control of the Electrical Contractor.
 - 2.3.1.2. Requests for substitutions to be accompanied by documentary proof of equality, difference in price and delivery, if any, in the form of certified quotations from suppliers of both specified and proposed equipment.
 - 2.3.1.3. In case of difference in price, the Owner is to receive all benefit of the difference in cost involved in any substitution and the Contract altered by change order to credit the Owner with any savings so obtained.
 - 2.3.1.4. Materials and equipment substituted or offered as alternatives to have spare parts and servicing available and to fit into the space allocation shown on the drawings.

- 2.3.1.5. If any material or equipment being considered for substitution involves additional design, architectural or engineering fees or other costs in checking whether or not the substitute material or equipment is suitable for the project, such fees or costs to be paid for by the Electrical Contractor. A minimum of five hundred dollars (\$500.00) to be applied to each piece of device or equipment requested for review. There is no guarantee that the reviewed product will be accepted by the Board or the reviewing Consultant.

2.4. WARNING SIGNS

- 2.4.1. Warning Signs: in accordance with requirements of Authority Having Jurisdiction and Consultants.
- 2.4.2. Comply with Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- 2.4.3. Provide warning labels in both English and French where project requires.

2.5. FINISHES

- 2.5.1. Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and two coats of finish enamel.
- 2.5.2. Paint outdoor electrical distribution equipment green finish to EEMAC Y1-2.
- 2.5.3. Paint indoor normal power distribution equipment enclosures light grey to EEMAC 2Y-1.
- 2.5.4. Paint indoor emergency power "Life Safety" distribution equipment enclosures Red.
- 2.5.5. Paint indoor emergency power "Non-life Safety" distribution equipment enclosures International Orange, RAL #2009.
- 2.5.6. Paint indoor UPS power distribution equipment enclosures Blue, RAL #5017.

2.6. CAN/CSA/NEMA RATING

- 2.6.1. All electrical equipment provided for this project to be CAN/CSA/NEMA Rated only. IEC Rated equipment is not acceptable and will not be accepted.

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. Comply with all Codes and Standards listed in PART 1 – GENERAL.

- 3.1.2. Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions, MSDS, and product datasheets.
- 3.1.3. Protect electrical equipment from dust and dirt. Plug or cap openings of conduits, fixtures and equipment during construction with approved materials for such use.
- 3.1.4. The Electrical Contractor to be responsible for the layout of the work of this contract, and for any damage caused to site or existing building, or other Contracts by improper location or carrying out of this work.
- 3.1.5. Ensure the prompt installation of the work of this contract in advance of concrete pouring or similar work.
- 3.1.6. No conduits for any power or systems to be permitted to be installed within the concrete slabs or concrete walls for this project except in select identified areas as per the drawings and specifications.
- 3.1.7. Furnish items to be "built-in" in ample time and give any necessary information and assistance in connection with the building-in of the same.
- 3.1.8. Manufactured products supplied with instructions for their use to be used in strict accordance with those instructions.
- 3.1.9. Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Construction Manager within the time limit stipulated.

3.2. SITE SERVICES

- 3.2.1. Site services: acquire a full working knowledge of the building site, services and any existing conditions thereon that may impact the project implementation. Review and examine the contract drawings and schedules of all trades prior to bid submittal to ensure full knowledge of the contract scope of work is ascertained.
- 3.2.2. The location of equipment indicated or specified is considered approximate. Review proposed locations with Consultant prior to installation.
- 3.2.3. Locate equipment, piping, duct and/or conduit to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

3.3. CONTRACTOR'S SHOP

- 3.3.1. Provide job site office, workshop, tools, scaffolds, material storage, etc., as required to complete the work of this contract and as directed by the Consultant.

- 3.3.2. The electrical contractor's office should as a minimum have the following capabilities, Phone, fax, email, High speed internet connection, router with a spare port and patch cable in order that the consultant can access the internet to deal with project related issues, copier and printer.

3.4. TEMPORARY SERVICES

- 3.4.1. Provide temporary electrical services with all poles, transformer and protection equipment from the locations as coordinated with the Owner. Provide all power panels at various locations on the site required to perform the work and as specified by the Consultant. All temporary services must be coordinated with the Owner. Do not use the permanent service of new or existing building for temporary power for construction unless specific written approval is obtained from the Consultant and coordinated with the Board

3.5. ACCESS TO ELECTRICAL EQUIPMENT, JUNCTION BOXES AND PULL BOXES

- 3.5.1. Clear access of a minimum of 1 meter must be provided for all electrical equipment, junction boxes and pull boxes.
- 3.5.2. All junction boxes and pull boxes to be within 600mm of an access panel or access luminaire and be easily accessed.
- 3.5.3. All electrical boxes that have free sides (IE: no conduits entering or leaving a side) to be kept clear in order to permit installation of conduits at a later date. Hence free sides of all electrical boxes to be clear of other conduits and services.

3.6. NAMEPLATES

- 3.6.1. Ensure manufacturer's nameplates, CAN/CSA labels and identification nameplates are visible and legible after equipment is installed.

3.7. LOCK OFF TABS

- 3.7.1. Provide lock off tabs on all panel boards for circuits that serve:
- 3.7.1.1. Emergency lighting;
 - 3.7.1.2. Exit lighting;
 - 3.7.1.3. Fire alarm equipment
 - 3.7.1.4. Security equipment.

3.8. FIRESTOPPING

- 3.8.1. Where cables, sleeves or conduits, pass through floors and fire rated walls pack space between wiring and sleeve or opening and seal with Hilti fire stopping system that is appropriate. The fire stopping installation must meet one of the approved details as

required to meet the rating of the assembly. Contact the Hilti representative to ensure that the installation meet Hilti requirements.

- 3.8.2. Care must be taken to keep integrity of all assemblies and maintain good finishes of surrounding areas, use tape for finish at edges when apply fire stopping materials. Provide at the end of the project a letter from Hilti indicating that the installation meets all requirements.
- 3.8.3. Meet all requirements of the Codes and fire proofing requirements as specified within the Contract Documents.
- 3.8.4. Provide Shop drawings for the various Fire stopping assemblies that will be utilized on the project to achieve the fire rating for construction assemblies or methods.
- 3.8.5. Refer (where applicable) to architectural drawings for fire separation diagrams. Such drawings may not be issued as part of the electrical documents; it is the electrical contractor's obligation to review all contract documentation of all involved disciplines (drawings and specifications).

3.9. BASES AND SUPPORTS

- 3.9.1. Where conduit and equipment are located on walls or slabs which will not permit the support of equipment, provide suitable supports to the building structure. Supports to be constructed of steel members or of steel pipe and fittings designed to safely support the equipment.
- 3.9.2. All equipment bases to be set on pads of kinetic pre-compressed fiberglass or vibration isolators sized to suit the equipment which they ought to support.

3.10. INSERTS, SLEEVES AND CURBS

- 3.10.1. Provide all inserts, sleeves and curbs required for the work of this contract.
- 3.10.2. Use only factory made threaded or toggle type inserts as required for support and anchors, properly sized for the load to be carried. Place inserts only in portions of the main structure and not in any finishing material.
- 3.10.3. Use factory made expansion shields where inserts cannot be placed, but only where approved by the Structural Engineer and only for loads of 50 kg or less.
- 3.10.4. Do not use powder activated tools unless with written permission of the Board's Representative.
- 3.10.5. Supply and locate all inserts, holes, anchor bolts and sleeves in time when walls, floors and roof are erected.

3.10.6. Size sleeves to provide 25 mm clearance all around.

3.10.7. Pack all sleeves between the conduit or cable passing through the sleeve and the sleeve and all spare sleeves with loose fiberglass insulation. Seal the annular space both sides as follows:

- 3.10.7.1. For all horizontal sleeves in exposed areas, use a seal of equal or better fire rating than the wall to be sealed.
- 3.10.7.2. For all horizontal concealed sleeves through fire walls and through walls separating areas of different air pressure, use a permanently resilient silicone base or equal sealing compound.
- 3.10.7.3. For all vertical sleeves through roofs, washrooms, janitor closets, equipment rooms, use permanently resilient silicone base or equal compound, non-flammable and waterproof. Ensure that the seal is compatible with floor and ceiling finishes. Check the room finishes schedules for further information.

3.11. CUT PATCH AND MAKE GOOD

- 3.11.1. All drilling, cutting, patching, concrete curbs, housekeeping pads and similar work required for installation of the specified systems shall be done under this contract.
- 3.11.2. Do not use powder actuated tools using explosives, unless permitted expressly by the Board in writing.
- 3.11.3. All cutting of steel shall be by mechanical cutters or saws. Torches and abrasives will only be permitted if there is no alternative. Prior to using torches or abrasives obtain Hot Work Permit in accordance with the Board's hot work procedure.
- 3.11.4. Scan the walls/floor slabs using ground penetrating radar (GPR) technology prior to making openings to determine the presence and location of embedded conduits or rebar. Clean the floors/walls immediately after core drilling/saw cutting is complete. All core drilling and loud and/or prolonged drilling shall be done after normal working hours (during silent hours) or as permitted by the "hammer drilling" schedule and 48 hour lead notice is to be provided to the building Owner to confirm contractor has met all mandatory conditions.
- 3.11.5. Core drilling through floors and walls shall be done with diamond drills only. The use of pneumatic hammers will not be permitted.
- 3.11.6. Patch and make good all surfaces cut, damaged or disturbed to the Board's approval. Match existing material, colour, finish and texture.
- 3.11.7. Welding and cutting: conform to Ontario Health and Safety Act O.Reg. 213/91 amended to O.Reg. 628/05 Construction Projects. Obtain a Hot Work Permit from the PM prior to welding and cutting operations. Follow the PM's hot work procedures.

- 3.11.8. Do not dispose of cement, mortar, plaster or other similar materials into drainage system. Contractor shall be liable for all costs associated with cleanup and reinstatement to original condition after doing so.
- 3.11.9. Dispose of sediment-containing liquids such as those resulting from core drilling or concrete cutting into designated drains. Flush drain with sufficient quantity of clean water to ensure that drain is free-flowing and unobstructed. Be liable for all costs associated with cleanup and reinstatement of drain and piping to original condition if found to be blocked by sediment.
- 3.11.10. Firestop all penetrations through wall and floor assemblies with Hilti Firestop solutions having a fire resistance rating not less than the assembly penetrated, colour: red. Unless otherwise noted, use the following assembly ratings: floors 2-hours; walls except around stairways – 1½ hours; walls around stairways: 2 – hours. Submit to Consultant for approval the proposed system detail sheets bearing the UL/CUL system number. Provide specified firestopping compound on both sides of assembly penetrated regardless of UL/CUL detail requirements.

3.12. REMOVALS AND DEMOLITION

- 3.12.1. The drawings indicate the general scope of electrical removals. Verify on site the exact requirements and extent of removals.
- 3.12.2. Visit the site to determine the extent of all removals.
- 3.12.3. Maintain, retain and make good as required all existing systems, branch wiring and feeders intended to remain operational in areas which are affected by these renovations.
- 3.12.4. Schedule all demolition work with project manager prior to any service interruption in occupied building area.
- 3.12.5. All shutdowns of existing base building systems shall be coordinated with the Board's representative. Pay for any cost incurred. All building services to remain fully operational during construction. Include in tender for off hours to install new breaker in existing panels and connection for feeders.
- 3.12.6. Remove electrical equipment as required complete with wiring up to associated panel. Remove all electrical components to be demolished or to be relocated and make safe all wiring. Hand over removed items to owner if requested. Dispose of the equipment properly which Owner does not wish to retain. Update existing panel directory which is affected.
- 3.12.7. Inform the Consultant and the Board immediately if any contaminated materials are found on site. Remove the items so that they can be packed and removed from the site. Provide assistance and cooperation for the complete removal.

- 3.12.8. The contractor shall be responsible to relocate any existing electrical equipment and/or wiring that will interfere with new construction.
- 3.12.9. The contractor shall be responsible for reconnection of any services that are to remain and have been disconnected during the course of demolition or construction.
- 3.12.10. All systems and components which are affected by the renovation shall remain operational subsequent to project completion. Reinstall immediately any services disrupted during demolition not intended to be removed as part of this contract at no extra cost.
- 3.12.11. Retain continuity of service of the fire alarm system to all occupied areas of the building.
- 3.12.12. The contractor shall advise security in the event that fire alarm system continuity is disrupted such that a fire watch can commence immediately.
- 3.12.13. Repair all damages inside and outside of the renovated areas caused by the demolition/construction without extra cost to the Owner.

3.13. REMOVED MATERIAL

- 3.13.1. All material removed during demolition shall become the property of the Contractor. The contractor shall remove material from the site and dispose of in accordance with provincial regulations. Under no circumstances is the contractor to use the building Owner's refuse containers for disposal.

3.14. NUMBER AND LOCATION OF OUTLETS

- 3.14.1. Provide outlets for power and systems of the number and in the locations shown on the drawings. Locate all outlets accurately with respect to building lines and in centering outlets due allowance to be made for overhead pipes, ducts, equipment and for variations in wall or ceiling finishes, window trim, paneling, etc. When necessary, make adjustments to ensure that all outlets are properly centered.
- 3.14.2. The location of any outlet may be changed without extra cost or credit providing that the new location is within 6 metres (20 feet) of that originally shown on the drawings and that instructions for the change are issued before installation of the outlet.
- 3.14.3. Do not mount outlet boxes in walls and partitions back-to-back and provide a minimum of 150 mm (6 inch) between boxes. Provide acoustic insulating medium in conduits which join boxes on opposite sides of same wall or partition. Acoustic properties of the wall to be matched or exceeded. Where applicable, for acoustically sensitive/critical rooms, more spacing separation and acoustic box seal is required. Refer to acoustic specifications and electrical drawings for detailed requirements.

3.15. MOUNTING HEIGHTS

- 3.15.1. The mounting height of equipment is measured from the finished floor to the centerline of the equipment unless specified or otherwise indicated.
- 3.15.2. If the mounting height of any equipment is not indicated, verify the mounting height before proceeding with the installation.
- 3.15.3. Install electrical equipment at the following mounting heights unless otherwise detailed or indicated. Refer to Architectural reflected ceiling plans, elevations, sections and details for final device location and to confirm all mounting heights.
- 3.15.4. All device mounting heights and orientation to be coordinated and confirmed by the Prime Consultant prior to installation.
 - 3.15.4.1. Local switches and control devices: 1100 mm (42 inch)
 - 3.15.4.2. Wall receptacles:
 - 3.15.4.2.1. General: 400 mm (15 inch)
 - 3.15.4.2.2. Above top of counters or backsplash: 175 mm (7 inch)
 - 3.15.4.2.3. In mechanical rooms: 1400 mm (55 inch)
- 3.15.5. Panelboards:
 - 3.15.5.1. 1800 mm (70 inch) to the top except that the panelboard not to be lower than 150 mm (6 inch) above the floor.
 - 3.15.5.2. Where multiple panelboards are mounted together, align the tops of all the panelboards or trims with the highest panelboard determining the height.
- 3.15.6. Fire alarm system pull stations: 1200 mm (48 inch)
 - 3.15.6.1. Fire alarm system speakers/strobes: 2300 mm (90 inch) and at least 150 mm (6 inch) below the ceiling measured to the top of device, or on ceiling.
 - 3.15.6.2. Fire Alarm System end of line resistors as per code requirements. EOL resistors to be grouped in service spaces.
 - 3.15.6.3. Fire fighter's phone: 1400 mm (55 inch) measured to the centerline of the enclosure.
- 3.15.7. Individual starters:
 - 3.15.7.1. 1500 mm (60 inch) to the top.
 - 3.15.7.2. Where multiple starters are mounted together, align the tops of all the starters or trims with the highest starter determining the height.
- 3.15.8. Splitters: 100 mm (4 inch) below the lowest equipment connected to the splitter.

3.16. MECHANICAL AND ELECTRICAL CO-ORDINATION OF RESPONSIBILITIES

3.16.1. The following is a list of mechanical and electrical responsibilities for the above mentioned project:

- 3.16.1.1. The Electrical Contractor to provide all starters or combinations starters/disconnects (fused or non-fused, as specified) for Mechanical Motors along with Line and Load side power wiring with the exception of Packaged Mechanical Equipment or Units.
- 3.16.1.2. Where so specified, Packaged Mechanical Equipment to be provided with its own integral disconnect(s), starters(s) or unit mounted VFD(s). With respect to Packaged Mechanical Equipment or Units the Electrical Contractor to provide the Line Side power wiring and connection(s) to the equipment connection point(s).
- 3.16.1.3. The Electrical Contractor to provide equipment isolation disconnect switches for all remote mechanical equipment unless otherwise indicated within the Mechanical Contract Documents or unless equipment is already furnished with a local disconnect. Where applicable, weather-proof enclosures shall be used. Remote definition: not in sight, as per NFPA-70 article 430.102
- 3.16.1.4. All BAS equipment and devices, to be supplied by the BAS vendor and installed by the mechanical Contractor.
- 3.16.1.5. The Mechanical Contractor to provide all control wiring, BAS wiring, and 120 volt control wiring for Mechanical Equipment or Units.
- 3.16.1.6. The Mechanical Contractor to provide all motors.
- 3.16.1.7. The Electrical Contractor to provide all fire alarm interface wiring to the Mechanical Equipment or Units for fire alarm Fan Shut Down, Fan Start-up as and for fire alarm Smoke Control.
- 3.16.1.8. The Electrical Contractor to provide all fire alarm wiring.
- 3.16.1.9. The Electrical Contractor to provide all relays for interface to control wiring for fan shutdown and fan start up for air handling units used as part of the smoke control system(s).
- 3.16.1.10. The Mechanical Contractor to provide all relays as required by the Mechanical Equipment or Units to connect to the various building systems.
- 3.16.1.11. The Mechanical Contractor to provide electric pipe heat tracing which to be based upon the self-limited type and be at 208 volts 1 Phase. The Electrical Contractor to provide 208 volts 1 Phase power connection(s) for the electric pipe heat tracing system(s). The Mechanical Contractor to provide loads requirements of the heat tracing to the Electrical Contractor prior to final power connection.
- 3.16.1.12. The Mechanical Contractor to provide electric heating, associated controls and control wiring. The Electrical Contractor to provide the Line Side power connection to the electric heating. The Mechanical Contractor to provide any framing required for recessed electric heating.
- 3.16.1.13. Separate Variable Frequency Drives (VFDs) to be provided by the Mechanical Contractor. Should the Mechanical Contractor change or modify motor sizes from

what is specified within the Bid Documents during any stage of this project the Mechanical Contractor will be responsible to cover all associated electrical costs such as revised motor starter and feeds, etc.

3.17. FLASHING

- 3.17.1. Coordinate with requirements for roofing, waterproofing and flashing with the Roofing Contractor.
- 3.17.2. Flash electrical parts passing through or built into a roof, an outside wall or a waterproof floor.
- 3.17.3. Provide 8-pound sheet lead flashing for cast iron or wrought iron sleeves passing through roof.
- 3.17.4. Flashing shall suit roof angle and shall extend minimum 450 mm (18 inch) on all sides. Leave flashing as directed by the Roofing Contractor for him to build into roofing, rendering a watertight connection.
- 3.17.5. Provide counter flashing on stacks, ducts and pipes passing through roof to fit over flashing or curb.
- 3.17.6. Provide sleeves passing through outside walls with lead or copper flashing as directed.

3.18. SYSTEM STARTUP

- 3.18.1. Inform Consultant and operating personnel in operation, care and maintenance of systems, system equipment and components.
- 3.18.2. Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- 3.18.3. Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.19. CLEANING

- 3.19.1. Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- 3.19.2. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

- 3.19.3. During the performance of the work and on the completion, remove from the site and premises all debris, rubbish and waste materials caused by the performance of the work for this contract. Remove all tools and surplus materials after completion and acceptance of the work.
- 3.19.4. Vacuum all equipment thoroughly at the time of final acceptance of the work. Clean plastic components and exposed components of luminaires in accordance with the manufacturer's recommendation.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. FACTORY TESTS.....	2
1.4. SUBMITTALS	2
1.5. APPLICABLE PUBLICATIONS.....	2
PART 2 - PRODUCTS	3
2.1. CONDUCTORS AND CABLES.....	3
2.2. SPLICES.....	4
2.3. CONNECTORS AND TERMINATIONS	4
2.4. CONTROL WIRING.....	5
2.5. WIRE LUBRICATING COMPOUND	5
PART 3 - EXECUTION	5
3.1. GENERAL	5
3.2. SPLICE AND TERMINATION INSTALLATION	6
3.3. CONDUCTOR IDENTIFICATION.....	6
3.4. FEEDER CONDUCTOR IDENTIFICATION	6
3.5. EXISTING CONDUCTORS	6
3.6. CONTROL WIRING INSTALLATION	7
3.7. CONTROL WIRING IDENTIFICATION	7
3.8. ACCEPTANCE CHECKS AND TESTS	7

PART 1 - GENERAL**1.1. DESCRIPTION**

- 1.1.1. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2. RELATED WORK

- 1.2.1. Section: 26 05 00 Common Work Results for Electrical.
- 1.2.2. Section: 26 05 26 Grounding and Bonding for Electrical Systems.
- 1.2.3. Section: 26 05 33 Raceway and Boxes for Electrical Systems.

1.3. FACTORY TESTS

- 1.3.1. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

1.4. SUBMITTALS**1.4.1. Shop Drawings:**

- 1.4.1.1. Submit sufficient information to demonstrate compliance with drawings and specifications.
- 1.4.1.2. Submit the following data for approval:
- 1.4.1.3. Electrical ratings and insulation type for each conductor and cable.
- 1.4.1.4. Splicing materials and pulling lubricant.

1.4.2. Certifications: Two weeks prior to final inspection, submit the following.

- 1.4.2.1. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
- 1.4.2.2. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.5. APPLICABLE PUBLICATIONS

- 1.5.1. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

- 1.5.1.1. CAN/CSA-C22.2 NO.38-10, Thermoset-Insulated Wire and Cables (Tri-national standard, with UL 44 and ANCE NMX-J-451).

- 1.5.1.3. CAN/CSA C22.2 NO.51-09, Armored Cables.
- 1.5.1.4. CAN/CSA C22.2 NO.75-08, Thermoplastic-Insulated Wires and Cables (Trinational
- 1.5.1.5. standard, with UL 83 and NMX-J-010-ANCE-2008).
- 1.5.1.6. CAN/CSA C22.2 NO.124-04 (R2009), Mineral-Insulated Cable.
- 1.5.1.7. CAN/CSA C22.2 NO.131-07, Type TECK 90 Cable.
- 1.5.1.8. CAN/CSA C22.2 NO. 239-09, Control and Instrumentation Cables.
- 1.5.1.9. American Society of Testing Material (ASTM):
 - 1.5.1.9.1. D2301-10 Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
 - 1.5.1.9.2. D2304-10 Test Method for Thermal Endurance of Rigid Electrical Insulating Materials
 - 1.5.1.9.3. D3005-10 Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
- 1.5.1.10. National Electrical Manufacturers Association (NEMA):
 - 1.5.1.10.1. WC 70-09 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
- 1.5.1.11. National Fire Protection Association (NFPA):
 - 1.5.1.11.1. 70-11 National Electrical Code (NEC)
- 1.5.1.12. Underwriters Laboratories, Inc. (UL):
- 1.5.1.13. 44-10 Thermoset-Insulated Wires and Cables
- 1.5.1.14. 83-08 Thermoplastic-Insulated Wires and Cables
- 1.5.1.15. 467-07 Grounding and Bonding Equipment
- 1.5.1.16. 486A-486B-03 Wire Connectors
- 1.5.1.17. 486C-04 Splicing Wire Connectors
- 1.5.1.18. 486D-05 Sealed Wire Connector Systems
- 1.5.1.19. 486E-09 Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
- 1.5.1.20. 514B-04 Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1. CONDUCTORS AND CABLES

- 2.1.1. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.
- 2.1.2. All conductors shall be copper.
- 2.1.3. Single Conductor and Cable:
 - 2.1.3.1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
 - 2.1.3.2. No. 8 AWG and larger: Stranded.

- 2.1.3.3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.

- 2.1.4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.2. SPLICES

- 2.2.1. Splices shall be in accordance with NEC and UL.

- 2.2.2. Above Ground Splices for No. 10 AWG and Smaller:

- 2.2.2.1. Solderless, screw on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
- 2.2.2.2. The integral insulator shall have a skirt to completely cover the stripped conductors.
- 2.2.2.3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

- 2.2.3. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:

- 2.2.3.1. Compression, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
- 2.2.3.2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
- 2.2.3.3. Splice and insulation shall be product of the same manufacturer.
- 2.2.3.4. All bolts, nuts, and washers used with splices shall be cadmium-plated.

- 2.2.4. Above Ground Splices for 250 kcmil and Larger:

- 2.2.4.1. Long barrel "butt-splice" or "sleeve" type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
- 2.2.4.2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
- 2.2.4.3. Splice and insulation shall be product of the same manufacturer.

2.3. CONNECTORS AND TERMINATIONS

- 2.3.1. Mechanical type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.

2.3.2. Long barrel compression type of high conductivity and corrosion resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.

2.3.3. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be cadmium-plated.

2.4. CONTROL WIRING

2.4.1. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.

2.4.2. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5. WIRE LUBRICATING COMPOUND

2.5.1. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

2.5.2. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1. GENERAL

3.1.1. Install conductors in accordance with the CSEC, NEC, as specified, and as shown on the drawings.

3.1.2. Install all conductors in metallic conduits, unless specified otherwise. Where multiple conduits follow the same routing, provide raceway systems.

3.1.3. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.

3.1.4. Conductors of different systems (e.g., 120 V and 347 V) shall not be installed in the same raceway.

3.1.5. Install conduit supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

3.1.6. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.

- 3.1.7. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
- 3.1.8. Use expanding foam or non-hardening duct-seal to seal conduits entering a building or where penetrating building walls/floors, after installation of conduits.
- 3.1.9. Conductor and Cable Pulling:
 - 3.1.9.1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
 - 3.1.9.2. Use nonmetallic pull ropes.
 - 3.1.9.3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
 - 3.1.9.4. All conductors in a single conduit shall be pulled simultaneously.
 - 3.1.9.5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - 3.1.9.6. No more than three branch circuits shall be installed in any one conduit.
 - 3.1.9.7. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2. SPLICE AND TERMINATION INSTALLATION

- 3.2.1. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.
- 3.2.2. Where the Consultant determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Board.

3.3. CONDUCTOR IDENTIFICATION

- 3.3.1. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

3.4. FEEDER CONDUCTOR IDENTIFICATION

- 3.4.1. In each interior pullbox, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.5. EXISTING CONDUCTORS

3.5.1. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.6. CONTROL WIRING INSTALLATION

3.6.1. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.

3.6.2. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

3.7. CONTROL WIRING IDENTIFICATION

3.7.1. Install a permanent wire marker on each wire at each termination.

3.7.2. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

3.7.3. Wire markers shall retain their markings after cleaning.

3.8. ACCEPTANCE CHECKS AND TESTS

3.8.1. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

3.8.1.1. Visual Inspection and Tests: Inspect physical condition.

3.8.2. Electrical tests:

3.8.2.1. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors' phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.

3.8.2.2. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.

3.8.2.3. Perform phase rotation test on all three-phase circuits

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. QUALITY ASSURANCE	2
1.4. SUBMITTALS	2
1.5. APPLICABLE PUBLICATIONS	3
PART 2 - PRODUCTS	3
2.1. GROUNDING AND BONDING CONDUCTORS	3
2.2. GROUND RODS	4
2.3. CONCRETE ENCASED ELECTRODE	4
2.4. GROUND CONNECTIONS	5
2.5. EQUIPMENT RACK AND CABINET GROUND BARS	5
2.6. GROUND TERMINAL BLOCKS	5
2.7. GROUNDING BUS BAR	5
PART 3 - EXECUTION	5
3.1. GENERAL	6
3.2. INACCESSIBLE GROUNDING CONNECTIONS	6
3.3. SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS	6
3.4. RACEWAY	7
3.5. OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT	8
3.6. CORROSION INHIBITORS	8
3.7. CONDUCTIVE PIPING	8
3.8. MAIN ELECTRICAL ROOM GROUNDING	9
3.9. GROUND RESISTANCE	9
3.10. GROUND ROD INSTALLATION	9
3.11. ACCEPTANCE CHECKS AND TESTS	9

PART 1 - GENERAL**1.1. DESCRIPTION**

- 1.1.1. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.
- 1.1.2. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by CESC and NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- 1.1.3. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

1.2. RELATED WORK

- 1.2.1. Section: 26 05 00 Common Work Results for Electrical.
- 1.2.2. Section: 26 05 19 Low-Voltage Electrical Power Conductors and Cables.
- 1.2.3. Section: 26 05 33 Raceway and Boxes for Electrical Systems.

1.3. QUALITY ASSURANCE

- 1.3.1. Quality Assurance shall be in accordance with Section: 26 05 00 Common Work Results for Electrical.

1.4. SUBMITTALS

- 1.4.1. Submit in accordance with requirements of Section: 26 05 00 Common Work Results for Electrical, and the following requirements:
 - 1.4.1.1. Shop Drawings:
 - 1.4.1.1.1. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - 1.4.1.1.2. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
 - 1.4.1.2. Test Reports:
 - 1.4.1.2.1. Two weeks prior to the final inspection, submit ground resistance field test reports to the Consultant
 - 1.4.1.3. Certifications:
 - 1.4.1.3.1. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5. APPLICABLE PUBLICATIONS

1.5.1. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

1.5.2. Canadian Standards Association (CSA)

1.5.2.1. CAN/CSA Standard C22.2 No.0.4-04(R2009) - Bonding of Electrical Equipment.

1.5.2.2. CAN/CSA Standard C22.2 No.41-07 - Grounding and Bonding Equipment (Bi-national standard, with UL 467).

1.5.2.3. Canadian and Ontario Electrical Safety Codes. (Latest Edition).

1.5.3. ANSI/TIA/EIA-607.

1.5.4. (CAN/CSA TS27) Best Practices for Ground and Bonding of Devices in Telecommunication Spaces.

1.5.5. Latest edition of IEEE Standard No. 80.

1.5.6. American Society for Testing and Materials (ASTM):

1.5.6.1. B1-13 Standard Specification for Hard-Drawn Copper Wire

1.5.6.2. B3-13 Standard Specification for Soft or Annealed Copper Wire

1.5.6.3. B8-11 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

1.5.7. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1.5.7.1. 81-12 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

1.5.8. National Fire Protection Association (NFPA):

1.5.8.1. 70-17 National Electrical Code (NEC)

1.5.8.2. 70E-15 National Electrical Safety Code

1.5.9. Underwriters Laboratories, Inc. (UL):

1.5.9.1. 44-14 Thermoset Insulated Wires and Cables

1.5.9.2. 83-14 Thermoplastic Insulated Wires and Cables

1.5.9.3. 467-13 Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1. GROUNDING AND BONDING CONDUCTORS

2.1.1. Install a complete, permanent and continuous system for earthing and grounding of networks, circuits and apparatus. The system shall include electrodes, conductor, connectors and required accessories on drawings to satisfy local authorities.

2.1.2. Install bonding/grounding connections from exposed non-current carrying metal parts of equipment including, but not necessarily limited to the following:

- 2.1.2.1. Frames of all motors.
- 2.1.2.2. All Starters.
- 2.1.2.3. Main Electrical Switchboards.
- 2.1.2.4. Medium Voltage Load Interrupter Switches.
- 2.1.2.5. Panelboards and Distribution Panels.
- 2.1.2.6. Isolations Switch(es).
- 2.1.2.7. Exterior mounted cable trays.
- 2.1.2.8. Raised floor pedestals.
- 2.1.2.9. Conductive Flooring.
- 2.1.2.10. Communication Rooms.
- 2.1.2.11. Transformers.
- 2.1.2.12. Transfer Switches.
- 2.1.2.13. Power Raceway System.
- 2.1.2.14. Generating equipment.

2.1.3. Install connectors according to manufacturer's recommendations.

2.1.4. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

2.1.5. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.

2.1.6. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

2.1.7. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.2. GROUND RODS

2.2.1. Copper clad steel, 19 mm (0.75 inch) diameter by 3m (10 feet) long.

2.2.2. Quantity of rods shall be as required to obtain the specified ground resistance.

2.3. CONCRETE ENCASED ELECTRODE

- 2.3.1. Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

2.4. GROUND CONNECTIONS

- 2.4.1. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

- 2.4.2. Above Grade:

- 2.4.2.1. Bonding Jumpers: Listed for use with copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
- 2.4.2.2. Connection to Building Steel: Exothermic-welded type connectors.
- 2.4.2.3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
- 2.4.2.4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.5. EQUIPMENT RACK AND CABINET GROUND BARS

- 2.5.1. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

2.6. GROUND TERMINAL BLOCKS

- 2.6.1. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.7. GROUNDING BUS BAR

- 2.7.1. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

PART 3 - EXECUTION

3.1. GENERAL

3.1.1. Installation shall be in accordance with the CEC, NEC, and manufacturer's instructions.

3.1.2. System Grounding:

- 3.1.2.1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
- 3.1.2.2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- 3.1.2.3. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2. INACCESSIBLE GROUNDING CONNECTIONS

3.2.1. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3. SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

3.3.1. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

3.3.2. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):

- 3.3.2.1. Provide a grounding electrode conductor sized per CESC and NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
- 3.3.2.2. Provide a supplemental ground electrode to bond to the grounding electrode system.

3.3.3. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:

- 3.3.3.1. Connect the equipment grounding conductors to the ground bus.
- 3.3.3.2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

3.3.4. Transformers:

- 3.3.4.1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.

- 3.3.4.2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest suitable component of the grounding electrode system.

3.4. RACEWAY

3.4.1. Conduit Systems:

- 3.4.1.1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
- 3.4.1.2. Nonmetallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
- 3.4.1.3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
- 3.4.1.4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

- 3.4.2. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.

3.4.3. Boxes, Cabinets, Enclosures, and Panelboards:

- 3.4.3.1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
- 3.4.3.2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

3.4.4. Wireway Systems:

- 3.4.4.1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
- 3.4.4.2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).

- 3.4.4.3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
- 3.4.4.4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).
- 3.4.4.5. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
- 3.4.5. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- 3.4.6. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.5. OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT

- 3.5.1. Fences shall be grounded with a ground rod at each fixed gate post and at each corner post.
- 3.5.2. Drive ground rods until the top is 300 mm (12 inches) below grade. Attach a No. 4 AWG copper conductor by exothermic weld to the ground rods, and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 300 mm (12 inches) of fence mesh and fasten by two approved bronze compression fittings, one to bond the wire to post and the other to bond the wire to fence. Each gate section shall be bonded to its gatepost by a 3 mm x 25 mm (0.375 inch x 1 inch) flexible, braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

3.6. CORROSION INHIBITORS

- 3.6.1. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.7. CONDUCTIVE PIPING

- 3.7.1. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- 3.7.2. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.8. MAIN ELECTRICAL ROOM GROUNDING

- 3.8.1. Provide ground bus bar and mounting hardware at each main electrical room where incoming feeders are terminated, as shown on the drawings. Connect to pigtail extensions of the building grounding ring, as shown on the drawings.

3.9. GROUND RESISTANCE

- 3.9.1. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.
- 3.9.2. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

3.10. GROUND ROD INSTALLATION

- 3.10.1. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.
- 3.10.2. For indoor installations, leave 100 mm (4 inches) of each rod exposed.
- 3.10.3. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.
- 3.10.4. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.

3.11. ACCEPTANCE CHECKS AND TESTS

- 3.11.1. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.
- 3.11.2. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- 3.11.3. Below-grade connections shall be visually inspected by the Consultant prior to backfilling. The Contractor shall notify the Consultant 24 hours before the connections are ready for inspection

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. QUALITY ASSURANCE	2
1.4. SUBMITTALS	2
1.5. APPLICABLE PUBLICATIONS.....	2
PART 2 - PRODUCTS	4
2.1. MATERIAL	4
2.2. CONDUIT FITTINGS	4
PART 3 - EXECUTION	7
3.1. PENETRATIONS	7
3.2. INSTALLATION, GENERAL.....	7
3.3. CONCEALED WORK INSTALLATION.....	8
3.4. EXPOSED WORK INSTALLATION	9
3.5. HAZARDOUS LOCATIONS.....	10
3.6. WET OR DAMP LOCATIONS	10
3.7. MOTORS AND VIBRATING EQUIPMENT	10
3.8. EXPANSION JOINTS.....	10
3.9. CONDUIT SUPPORTS.....	11
3.10. BOX INSTALLATION.....	12

PART 1 - GENERAL**1.1. DESCRIPTION**

- 1.1.1. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- 1.1.2. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2. RELATED WORK

- 1.2.1. Section: 26 05 00 Common Work Results for Electrical.

1.3. QUALITY ASSURANCE

- 1.3.1. Refer to Paragraph, QUALIFICATIONS, in Section: 26 05 00 Common Work Results for Electrical.

1.4. SUBMITTALS

- 1.4.1. Submit in accordance with Section: 26 05 00 Common Work Results for Electrical.

- 1.4.2. Shop Drawings:

- 1.4.2.1. Size and location of main feeders.
 - 1.4.2.2. Size and location of panels and pull-boxes.
 - 1.4.2.3. Layout of required conduit penetrations through structural elements.
 - 1.4.2.4. Submit the following data for approval:
 - 1.4.2.5. Raceway types and sizes.
 - 1.4.2.6. Conduit bodies, connectors and fittings.
 - 1.4.2.7. Splitter troughs
 - 1.4.2.8. Junction and pull boxes, types and sizes.

- 1.4.3. Certifications: Two weeks prior to final inspection, submit the following:

- 1.4.3.1. Certification by the manufacturer that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment conform to the requirements of the drawings and specifications.
 - 1.4.3.2. Certification by the Contractor that raceway, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

1.5. APPLICABLE PUBLICATIONS

1.5.1. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

1.5.2. Canadian Standards Association (CSA International)

- 1.5.2.1. CAN/CSA C22.2 No. 18.3-12, Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B).
- 1.5.2.2. CAN/CSA C22.2 No. 18.4-04 (R2009), Hardware for the Support of Conduit, Tubing, and Cable (Bi-National standard, with UL 2239).
- 1.5.2.3. CAN/CSA C22.2 No. 18.5-02 (R2012), Positioning Devices (Bi-National standard, with UL 1565).
- 1.5.2.4. C22.2 NO.45.1-07, Electrical Rigid Metal Conduit – Steel (Tri-national standard, with UL 6 and NMX-J-534-ANCE-2007).
- 1.5.2.5. C22.2 No.56-04 (R2009) Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- 1.5.2.6. C22.2 NO.83-M1985 (R2008), Electrical Metallic Tubing.
- 1.5.2.7. C22.2 No.211.2-06 (R2011) Rigid PVC (Unplasticized) Conduit.
- 1.5.2.8. CAN/CSA C22.2 NO.227.1-06 (R2011), Electrical Nonmetallic Tubing (Bi-National standard, with UL 1653).
- 1.5.2.9. CAN/CSA C22.2 NO.227.2.1-04 (R2009), Liquid-Tight Flexible Nonmetallic Conduit (Bi-National standard, with UL 1660).
- 1.5.2.10. CAN/CSA C22.2 No. 227.3-05 (R2010), Nonmetallic Mechanical Protection Tubing (NMPT), (Bi-national standard, with UL 1696).

1.5.3. American National Standards Institute (ANSI):

- 1.5.3.1. C80.1-05 Electrical Rigid Steel Conduit
- 1.5.3.2. C80.3-05 Steel Electrical Metal Tubing
- 1.5.3.3. C80.6-05 Electrical Intermediate Metal Conduit

1.5.4. National Fire Protection Association (NFPA):

1.5.5. 70-11 National Electrical Code (NEC)

1.5.6. Underwriters Laboratories, Inc. (UL):

- 1.5.6.1. 1-05 Flexible Metal Conduit
- 1.5.6.2. 5-11 Surface Metal Raceway and Fittings
- 1.5.6.3. 6-07 Electrical Rigid Metal Conduit - Steel
- 1.5.6.4. 50-95 Enclosures for Electrical Equipment
- 1.5.6.5. 360-13 Liquid-Tight Flexible Steel Conduit
- 1.5.6.6. 467-13 Grounding and Bonding Equipment
- 1.5.6.7. 514A-13 Metallic Outlet Boxes

1.5.6.8.	514B-12	Conduit, Tubing, and Cable Fittings
1.5.6.9.	514C-07	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
1.5.6.10.	797-07	Electrical Metallic Tubing
1.5.6.11.	1242-06	Electrical Intermediate Metal Conduit - Steel

1.5.7. National Electrical Manufacturers Association (NEMA):

1.5.7.1.	FB1-12	Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
1.5.7.2.	FB2.10-13	Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)
1.5.7.3.	FB2.20-12	Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

PART 2 - PRODUCTS

2.1. MATERIAL

- 2.1.1. Conduit Size: In accordance with the CEC/NFPA-70, but not less than 13 mm (0.5-inch) unless otherwise shown.
- 2.1.2. Rigid Steel Conduit (RMC): Shall conform to CAN/CSA C22.2 NO.45.1, UL 6 and ANSI C80.1. *Application: for all outdoor installations and other locations where specified or shown on the drawings.*
- 2.1.3. Rigid Intermediate Steel Conduit (IMC): Shall conform to CAN/CSA C22.2 NO.18.3, UL 1242 and ANSI C80.6. *Application: for all outdoor installations and other locations where specified or shown on the drawings.*
- 2.1.4. Electrical Metallic Tubing (EMT): Shall conform to CAN/CSA C22.2 NO.83, UL 797 and ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less. *Application: for all indoor installations and other locations where specified or shown on the drawings.*
- 2.1.5. Flexible Metal Conduit: Shall conform to CAN/CSA C22.2 NO.56, UL 1. *Application: last 1000 mm (40") before final connections to burners and other locations where specified or shown on the drawings.*
- 2.1.6. Liquid-tight Flexible Metal Conduit: Shall conform to CAN/CSA C22.2 NO.227.2.1, UL 360. *Applications: last 1000 mm (40") before connecting to motors and other vibrating equipment and other locations where specified or shown on the drawings.*

2.2. CONDUIT FITTINGS

2.2.1. Rigid Steel and Intermediate Metallic Conduit Fittings:

- 2.2.1.1. Fittings shall meet the requirements of UL 514B and NEMA FB1.
- 2.2.1.2. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
- 2.2.1.3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
- 2.2.1.4. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
- 2.2.1.5. Erickson (Union Type) and Set Screw Type Couplings: Approved for use in concrete is permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
- 2.2.1.6. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2.2.2. Electrical Metallic Tubing Fittings:

- 2.2.2.1. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
- 2.2.2.2. Only steel or malleable iron materials are acceptable.
- 2.2.2.3. Both compression and setscrew fittings are allowed, but one choice is to be made for a project. Fittings are to be of uniform type throughout the project.
- 2.2.2.4. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats
- 2.2.2.5. Setscrew Couplings and Connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding
- 2.2.2.6. Indent-type connectors or couplings are prohibited.
- 2.2.2.7. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

2.2.3. Flexible Metal Conduit Fittings:

- 2.2.3.1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
- 2.2.3.2. Clamp-type, with insulated throat.
- 2.2.3.3. Liquid tight Flexible Metal Conduit Fittings:
- 2.2.3.4. Fittings shall meet the requirements of UL 514B and NEMA FB1.
- 2.2.3.5. Only steel or malleable iron materials are acceptable.

- 2.2.3.6. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- 2.2.4. Surface Metal Raceway Fittings:
 - 2.2.4.1. As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
- 2.2.5. Expansion and Deflection Couplings:
 - 2.2.5.1. Conform to UL 467 and UL 514B.
 - 2.2.5.2. Accommodate a 19 mm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - 2.2.5.3. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the CEC tables for equipment grounding conductors.
- 2.2.6. Jacket: Flexible, corrosion resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.
- 2.2.7. Conduit Supports:
 - 2.2.7.1. Parts and Hardware: Zinc coat or provide equivalent corrosion protection.
 - 2.2.7.2. Individual Conduit Hangers: Designed for the purpose, having a pre assembled closure bolt and nut, and provisions for receiving a hanger rod.
 - 2.2.7.3. Multiple Conduit (Trapeze) Hangers: Not less than 38 mm x 38 mm (1.5 x 1.5 inches), 12-gauge steel, cold-formed, lipped channels; with not less than 9 mm (0.375-inch) diameter steel hanger rods.
 - 2.2.7.4. Solid Masonry and Concrete Anchors: Self drilling expansion shields, or machine bolt expansion.
- 2.2.8. Outlet, Junction, and Pull Boxes:
 - 2.2.8.1. Applicable Publications
 - 2.2.8.1.1. CAN/CSA C22.2 NO.18.1-04 (R2009), Metallic Outlet Boxes (Tri-National standard with ANCE NMX-J-023/1 and UL 514A).
 - 2.2.8.1.2. C22.2 NO.18.2-06, Nonmetallic Outlet Boxes.
 - 2.2.8.1.3. CAN/CSA C22.2 NO.18.3-12, Conduit, Tubing and Cable Fittings (Tri-national standard, with ANCE NMX-J-017 and UL 514B).
 - 2.2.8.1.4. UL-50 and UL-514A.
 - 2.2.8.2. Rustproof cast metal where required by the NEC or shown on drawings.
 - 2.2.8.3. Sheet Metal Boxes: Galvanized steel, except where shown on drawings.

2.2.9. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

2.2.10. Splitter troughs

2.2.10.1. Sheet metal enclosure with welded edges and hinged shaped cover with locking facility when closed.

2.2.10.2. Copper bus bars c/w terminals corresponding to the number and size of the incoming and outgoing conductors as shown.

2.2.10.3. Unless otherwise indicated the splitters shall have sufficient length to accommodate the layout of the secondary equipment.

2.2.10.4. Supply at least three space terminals for each terminal size in 400 A and less splitters.

PART 3 - EXECUTION

3.1. PENETRATIONS

3.1.1. Cutting or Holes:

3.1.1.1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams.

3.1.1.2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw.

3.1.1.3. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases.

3.1.1.4. Verify that roof penetration details are shown on drawings.

3.1.1.5. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight.

3.2. INSTALLATION, GENERAL

3.2.1. In accordance with ULC, OESC, CEC, NEC, NEMA, as shown on drawings, and as specified herein.

3.2.2. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.

3.2.3. Install conduit as follows:

3.2.3.1. In fully completed mechanically and electrically continuous runs before pulling in cables or wires.

- 3.2.3.2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
 - 3.2.3.3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
 - 3.2.3.4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
 - 3.2.3.5. Cut conduits square, ream, remove burrs, and draw up tight.
 - 3.2.3.6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials or as shown on drawings.
 - 3.2.3.7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
 - 3.2.3.8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
 - 3.2.3.9. Close ends of empty conduits with plugs or caps at the rough in stage until wires are pulled in, to prevent entry of debris.
 - 3.2.3.10. Conduit installations under fume and vent hoods are prohibited.
 - 3.2.3.11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
 - 3.2.3.12. Flashing of penetrations of the roof membrane is shown on the drawing details.
 - 3.2.3.13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
- 3.2.4. Conduit Bends:
- 3.2.4.1. Make bends with standard conduit bending machines.
 - 3.2.4.2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
 - 3.2.4.3. Bending of conduits with a pipe tee or vise is prohibited.
- 3.2.5. Layout and Homeruns:
- 3.2.5.1. Install conduit with wiring, including homeruns, as shown on drawings.
 - 3.2.5.2. Deviations: Make only where necessary to avoid interferences.

3.3. CONCEALED WORK INSTALLATION

3.3.1. In Concrete:

- 3.3.1.1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.

- 3.3.1.2. Align and run conduit in direct lines.
 - 3.3.1.3. Install conduit through concrete beams only:
 - 3.3.1.4. Where shown on the structural drawings.
 - 3.3.1.5. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
 - 3.3.1.6. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
 - 3.3.1.7. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
 - 3.3.1.8. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (0.75-inch) of concrete around the conduits.
 - 3.3.1.9. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.
- 3.3.2. Above Furred or Suspended Ceilings and in Walls:
- 3.3.2.1. Conduit for Conductors 600 V and Below: EMT.
 - 3.3.2.2. Align and run conduit parallel or perpendicular to the building lines.
 - 3.3.2.3. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
 - 3.3.2.4. Tightening set screws with pliers is prohibited.
 - 3.3.2.5. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4. EXPOSED WORK INSTALLATION

- 3.4.1. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- 3.4.2. Conduit for Conductors 600 V and Below: Rigid steel or IMC (outdoors), EMT (indoors). Mixing different types of conduits in the system is prohibited.
- 3.4.3. Align and run conduit parallel or perpendicular to the building lines.
- 3.4.4. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- 3.4.5. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.
- 3.4.6. Surface Metal Raceways: Use only where shown on drawings.
- 3.4.7. Painting:
 - 3.4.7.1. Paint exposed conduit as specified

3.5. HAZARDOUS LOCATIONS

- 3.5.1. Use rigid steel conduit only.
- 3.5.2. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.6. WET OR DAMP LOCATIONS

- 3.6.1. Use rigid steel or IMC conduits unless as shown on drawings.
- 3.6.2. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.
- 3.6.3. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.
- 3.6.4. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

3.7. MOTORS AND VIBRATING EQUIPMENT

- 3.7.1. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- 3.7.2. Use liquid tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.
- 3.7.3. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

3.8. EXPANSION JOINTS

- 3.8.1. Conduits 75 mm (3 inch) and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

3.8.2. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

3.8.3. Install expansion and deflection couplings where shown.

3.9. CONDUIT SUPPORTS

3.9.1. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

3.9.2. Use pipe straps or individual conduit hangers for supporting individual conduits.

3.9.3. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs). Attach each conduit with U bolts or other approved fasteners.

3.9.4. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T bars, angle supports, and similar items.

3.9.5. Fasteners and Supports in Solid Masonry and Concrete:

3.9.5.1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.

3.9.6. Existing Construction:

3.9.6.1. Steel expansion anchors not less than 6 mm (0.25-inch) bolt size and not less than 28 mm (1.125 inch) in embedment.

3.9.6.2. Power set fasteners not less than 6 mm (0.25-inch) diameter with depth of penetration not less than 75 mm (3 inch).

3.9.6.3. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

3.9.6.4. Hollow Masonry: Toggle bolts.

3.9.6.5. Bolts supported only by plaster or gypsum wallboard are not acceptable.

3.9.6.6. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

3.9.6.7. Attachment by wood plugs, raw plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

3.9.6.8. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

3.9.6.9. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

- 3.9.6.10. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.10. BOX INSTALLATION

3.10.1. Boxes for Concealed Conduits:

3.10.1.1. Flush-mounted.

- 3.10.1.1.1. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
 - 3.10.1.1.2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.
 - 3.10.1.1.3. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.
 - 3.10.1.1.4. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap in metal covers for sheet metal boxes.
 - 3.10.1.1.5. Outlet boxes mounted back to back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.
- 3.10.1.2. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.
- 3.10.1.3. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.
- 3.10.1.4. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG FA JB No. 1."
- 3.10.1.5. On all branch circuit junction box covers, identify the circuits with black marker.

TABLE OF CONTENTS

PART 1 - GENERAL 2

1.1. DESCRIPTION 2

1.2. RELATED WORK 2

1.3. QUALITY ASSURANCE 2

1.4. SUBMITTALS 2

PART 2 - PRODUCTS 2

2.1. TRANSFORMERS 3

PART 3 - EXECUTION 4

3.1. INSTALLATION 4

3.2. ACCEPTANCE CHECKS AND TESTS 4

3.3. FOLLOW-UP VERIFICATION 5

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section specifies the furnishing, installation, connection, and testing of low-voltage dry-type general-purpose transformers, indicated as transformers in this section.

1.2. RELATED WORK

- 1.2.1. Section 26 05 00
- 1.2.2. Section 26 05 19
- 1.2.3. Section 26 05 33

1.3. QUALITY ASSURANCE

- 1.3.1. Quality Assurance shall be in accordance with Section 26 05 00 COMMON RESULTS – ELECTRICAL WORK.

1.4. SUBMITTALS

1.4.1. Shop Drawings

- 1.4.1.1. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, temperature rise, wiring and connection diagrams, plan, front, side, and rear elevations, accessories, and device nameplate data.

1.4.2. Manuals

- 1.4.2.1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets and wiring diagrams.
- 1.4.2.2. Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the transformers.
- 1.4.2.3. Include information for testing, repair, troubleshooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
- 1.4.2.4. Certifications: Two weeks prior to final inspection, submit the following.
- 1.4.2.5. Certification by the manufacturer that the transformers conform to the requirements of the drawings and specifications.
- 1.4.2.6. Certification by the Contractor that the transformers have been properly installed, adjusted, and tested.

PART 2 - PRODUCTS

2.1. TRANSFORMERS

2.1.1. Unless otherwise specified, transformers shall be in accordance with CESC, NEMA, NFPA, UL and as shown on the drawings.

2.1.2. Transformers shall have the following features:

2.1.2.1. Self-cooled by natural convection, isolating windings, dry-type. Rating and winding connections shall be as shown on the drawings.

2.1.2.2. Ratings shown on the drawings are for continuous duty without the use of cooling fans.

2.1.2.3. Copper windings.

2.1.3. Insulation systems:

2.1.3.1. Transformers 30 kVA and larger: UL rated 220 °C (428 °F) system with an average maximum rise by resistance of 150 °C (302 °F) in a maximum ambient of 40 °C (104 °F).

2.1.3.2. Transformers below 30 kVA: Same as for 30 kVA and larger or UL rated 185 °C (365 °F) system with an average maximum rise by resistance of 115 °C (239 °F) in a maximum ambient of 40 °C (104 °F).

2.1.4. Core and coil assemblies:

2.1.4.1. Rigidly braced to withstand the stresses caused by short-circuit currents and rough handling during shipment.

2.1.4.2. Cores shall be grain-oriented, non-aging, and silicon steel.

2.1.4.3. Coils shall be continuous windings without splices except for taps.

2.1.4.4. Coil loss and core loss shall be minimized for efficient operation.

2.1.4.5. Primary and secondary tap connections shall be brazed or pressure type.

2.1.4.6. Coil windings shall have end filters or tie-downs for maximum strength.

2.1.4.7. Average audible sound levels shall comply with NEMA.

2.1.4.8. If not shown on drawings, nominal impedance shall be as permitted by NEMA.

2.1.4.9. Single phase transformers rated 15 kVA through 25 kVA shall have two 5% full capacity taps below normal rated primary voltage. All transformers rated 30 kVA and larger shall have two 2.5% full capacity taps above, and four 2.5% full capacity taps below normal rated primary voltage.

2.1.4.10. Core assemblies shall be grounded to their enclosures with adequate flexible ground straps.

2.1.5. Enclosures:

2.1.5.1. Comprised of not less than code gauge steel.

2.1.5.2. Outdoor enclosures shall be NEMA 3R.

- 2.1.5.3. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.
 - 2.1.5.4. Ventilation openings shall prevent accidental access to live components.
 - 2.1.5.5. The enclosure at the factory shall be thoroughly cleaned and painted with manufacturer's prime coat and standard finish.
 - 2.1.5.6. Standard NEMA features and accessories, including ground pad, lifting provisions, and nameplate with the wiring diagram and sound level indicated.
 - 2.1.5.7. Dimensions and configurations shall conform to the spaces designated for their installations.
- 2.1.6. Standard of Acceptance:
- 2.1.6.1. Eaton
 - 2.1.6.2. Cutler Hammer
 - 2.1.6.3. General Electric

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. Installation of transformers shall be in accordance with the CEC, NEC, as recommended by the equipment manufacturer and as shown on the drawings.
- 3.1.2. Anchor transformers with rustproof bolts, nuts, and washers, in accordance with manufacturer's instructions, and as shown on drawings.
- 3.1.3. Exterior Location: Mount transformers on concrete slab. Unless otherwise indicated, the slab shall be at least 200 mm (8 inches) thick, reinforced with a 150 by 150 mm (6 by 6 inches) No. 6 mesh placed uniformly 100 mm (4 inches) from the top of the slab. Slab shall be placed on a 150 mm (6 inches) thick, well-compacted gravel base. The top of the concrete slab shall be approximately 100 mm (4 inches) above the finished grade. Edges above grade shall have 15 mm (1/2 inch) chamfer. The slab shall be of adequate size to project at least 200 mm (8 inches) beyond the equipment. Provide conduit turn-ups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface.
- 3.1.4. Install transformers with manufacturer's recommended clearance from wall and adjacent equipment for air circulation. Minimum clearance shall be 150 mm (6 inches).
- 3.1.5. Install transformers on vibration pads designed to suppress transformer noise and vibrations.

3.2. ACCEPTANCE CHECKS AND TESTS

3.2.1. Perform tests in accordance with the manufacturer's recommendations. In addition, include the following:

- 3.2.1.1. Visual Inspection and Tests.
- 3.2.1.2. Compare equipment nameplate data with specifications and approved shop drawings.
- 3.2.1.3. Inspect physical and mechanical condition.
- 3.2.1.4. Inspect all field-installed bolted electrical connections, using the calibrated torque-wrench method to verify tightness of accessible bolted electrical connections.
- 3.2.1.5. Perform specific inspections and mechanical tests as recommended by manufacturer.
- 3.2.1.6. Verify correct equipment grounding.
- 3.2.1.7. Verify proper secondary phase-to-phase and phase-to-neutral voltage after energization and prior to connection to loads.

3.3. FOLLOW-UP VERIFICATION

3.3.1. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the transformers are in good operating condition, and properly performing the intended function.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. SUBMITTALS	2
1.4. APPLICABLE PUBLICATIONS	3
PART 2 - PRODUCTS	3
2.1. PANELBOARD-MOUNTED FUSED DISCONNECTS.....	3
2.2. FUSED DISCONNECT SWITCHES RATED 600 AMPERES AND LESS	4
2.3. UNFUSED DISCONNECT SWITCHES RATED 600 AMPERES AND LESS	5
2.4. CIRCUIT BREAKER TYPE DISTRIBUTION PANELS	5
2.5. MOTOR RATED TOGGLE SWITCHES.....	6
2.6. CARTRIDGE FUSES.....	6
2.7. MOLDED CASE CIRCUIT BREAKERS	6
PART 3 - EXECUTION	7
3.1. INSTALLATION.....	7
3.2. MOLDED CASE CIRCUIT BREAKER	7
3.3. FUSES	7
3.4. IDENTIFICATION.....	7
3.5. ACCEPTANCE CHECKS AND TESTS	8
3.6. SPARE PARTS.....	8

PART 1 - GENERAL**1.1. DESCRIPTION**

- 1.1.1. This section specifies the furnishing, installation, and connection of fused and unfused disconnect switches (indicated as switches in this section), circuit breaker distribution panels and separately-enclosed circuit breakers for use in electrical systems rated 600 V and below.

1.2. RELATED WORK

- 1.2.1. Section: 26 05 00 Common Work Results for Electrical.
- 1.2.2. Section: 26 05 19 Low-Voltage Electrical Power Conductors and Cables.
- 1.2.3. Section: 26 05 33 Raceway and Boxes for Electrical Systems.

1.3. SUBMITTALS

- 1.3.1. Submit the following.

- 1.3.1.1. Shop Drawings:

- 1.3.1.1.1. Submit sufficient information to demonstrate compliance with drawings and specifications.
- 1.3.1.1.2. Submit the following data for approval:
- 1.3.1.1.3. Electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, fuses, circuit breakers, wiring and connection diagrams, accessories, and device nameplate data.

- 1.3.1.2. Manuals:

- 1.3.1.2.1. Submit complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering fuses, circuit breakers, and replacement parts.
- 1.3.1.2.2. Include schematic diagrams, with all terminals identified, matching terminal identification in the enclosed switches and circuit breakers.
- 1.3.1.2.3. Include information for testing, repair, troubleshooting, assembly, and disassembly.
- 1.3.1.2.4. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
- 1.3.1.2.5. Certifications: Two weeks prior to final inspection, submit the following.
- 1.3.1.2.6. Certification by the manufacturer that the enclosed switches and circuit breakers conform to the requirements of the drawings and specifications.
- 1.3.1.2.7. Certification by the Contractor that the enclosed switches and circuit breakers have been properly installed, adjusted, and tested.

1.4. APPLICABLE PUBLICATIONS

1.4.1. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

1.4.2. CAN/CSA-22.2

1.4.2.1. CAN/CSA-C22.2 No. 4-04 (R2009), Enclosed Switches.

1.4.2.2. CAN/CSA C22.2 NO.39-M1987 (R2007) Fuseholder Assemblies).

1.4.3. National Electrical Manufacturers Association (NEMA):

1.4.3.1. Low Voltage Cartridge Fuses

1.4.3.2. Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

1.4.4. National Fire Protection Association (NFPA):

1.4.4.1. 70-11 National Electrical Code (NEC)

1.4.5. Underwriters Laboratories, Inc. (UL):

1.4.5.1. 98-07 Enclosed and Dead-Front Switches

1.4.5.2. 248-00 Low Voltage Fuses

1.4.5.3. 489-09 Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS**2.1. PANELBOARD-MOUNTED FUSED DISCONNECTS**

2.1.1. Circuit breakers shall be per CAN/CSA22.2 #4, UL, NEC, as shown on the drawings, and as specified.

2.1.2. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

2.1.3. Circuit breakers shall be bolt-on type.

2.1.4. Circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:

2.1.4.1. 120/208 V Panelboard: 10,000 A symmetrical.

2.1.4.2. 120/240 V Panelboard: 10,000 A symmetrical.

2.1.4.3. 347/575 V Panelboard: 14,000 A symmetrical.

- 2.1.4.4. Circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for less than 400 A frame. Circuit breakers with 400 A frames and above shall have magnetic trip, adjustable from 5x to 10x.

2.1.5. Circuit breaker features shall be as follows:

- 2.1.5.1. A rugged, integral housing of molded insulating material.
- 2.1.5.2. Silver alloy contacts.
- 2.1.5.3. Arc quenchers and phase barriers for each pole.
- 2.1.5.4. Quick-make, quick-break, operating mechanisms.
- 2.1.5.5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
- 2.1.5.6. Electrically and mechanically trip free.
- 2.1.5.7. An operating handle which indicates closed, tripped, and open positions.
- 2.1.5.8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
- 2.1.5.9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.

2.2. FUSED DISCONNECT SWITCHES RATED 600 AMPERES AND LESS

- 2.2.1. Switches shall be in accordance with CAN/CSA22.2 #4, NEMA, NEC, UL, as specified, and as shown on the drawings.
- 2.2.2. Shall be NEMA classified General Duty (GD) for 240 V switches, and NEMA classified Heavy Duty (HD) for 575 V switches.
- 2.2.3. Shall be horsepower (HP) rated.
- 2.2.4. NEMA 1 (indoor applications), NEMA 3R (outdoor or wet environment)
- 2.2.5. Shall have the following features:
 - 2.2.5.1. Switch mechanism shall be the quick-make, quick-break type.
 - 2.2.5.2. Copper blades, visible in the open position.
 - 2.2.5.3. An arc chute for each pole.
 - 2.2.5.4. External operating handle shall indicate open and closed positions, and have lock open padlocking provisions.
 - 2.2.5.5. Mechanical interlock shall permit opening of the door only when the switch is in the open position, defeatable to permit inspection.
 - 2.2.5.6. Fuse holders for the sizes and types of fuses specified.

2.2.5.7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.

2.2.5.8. Ground lugs for each ground conductor.

2.2.6. Enclosures:

2.2.6.1. Shall be the NEMA types shown on the drawings.

2.2.6.2. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions.

2.2.6.3. Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel.

2.2.7. Standards of Acceptance: Eaton, Cutler Hammer, Siemens, Square D

2.3. UNFUSED DISCONNECT SWITCHES RATED 600 AMPERES AND LESS

2.3.1. Shall be the same as fused switches, but without provisions for fuses.

2.3.2. Standards of acceptance: same as fused disconnects

2.4. CIRCUIT BREAKER TYPE DISTRIBUTION PANELS

2.4.1. Distribution panels conforming to CSA C22.2 no. 29 standard.

2.4.2. Supplied by the same and only manufacturer.

2.4.3. As specified on the drawings

2.4.4. Arrange bus bars per phase order. All circuits shall be identified by a letter, as shown on drawings.

2.4.5. Panels shall have bus bars, and number of branch circuits and circuit breakers as shown.

2.4.6. Panels to be complete with door, lock and two keys, locks and keys to be interchangeable for all panels of the same type.

2.4.7. Bus bars shall be copper as the supports and circuit breakers material have the same expansion coefficients, with full capacity neutral.

2.4.8. For surface or flush mounting as shown on drawings.

2.4.9. Panel bus bars to be compatible with bolted-on circuit breakers.

2.4.10. Standard finish: ASA 61 grey baked enamel.

2.4.11. Circuit breakers: conforming to article "Molded Case Circuit Breakers" described herein.

2.4.12. The grounding bus bar shall conform to article Grounding and Bonding.

2.4.13. Acceptable manufacturers:

2.4.13.1. Eaton, Siemens, GE.

2.5. MOTOR RATED TOGGLE SWITCHES

2.5.1. Not applicable

2.6. CARTRIDGE FUSES

2.6.1. Shall be in accordance with CSA C22.2 no. 106 and C22.2 no. 248 standards.

2.6.2. High rupturing capacity (HRC) fuses 200kA RMS symmetrical and current limiting fuses.

2.6.3. Supplied by the same and only manufacturer.

2.6.4. Service Entrance: Class L, fast acting.

2.6.5. Feeders: Class L, fast acting

2.6.6. Motor and Transformer Branch Circuits: Class RK1 time delay.

2.6.7. Other Branch Circuits: Class J (less than 600A) or Class L (over 600A), fast acting.

2.6.8. Control Circuits: Class CC fast acting

2.6.9. Standard of Acceptance: Cooper Busman, Eaton

2.7. MOLDED CASE CIRCUIT BREAKERS

2.7.1. Molded case circuit breakers conforming to CSA C22.2 no. 5 standard.

2.7.2. Circuit protection devices contained in plastic insulated enclosures.

2.7.3. Bolted to the panel bus bars.

2.7.4. Quick make quick break mechanism.

2.7.5. Manually operated.

2.7.6. Complete with thermal and magnetic trip unit compensated for an ambient temperature of 40 °C (104 °F).

2.7.7. Multi-pole breakers to have a common trip device and operating lever.

2.7.8. In 120 or 208 Volts circuits use, unless otherwise noted on the distribution diagram or on the panel description sheets, single, two or three pole circuit breakers having the ratings as shown and with a 10 kA minimum RMS, symmetrical rupturing capacity.

2.7.9. Authentication of new breakers (not counterfeited)

- 2.7.9.1. Except otherwise noted, all breakers installed in panels (new or existing) shall be new and obtained exclusively from a distributor authorized by manufacturer.
- 2.7.9.2. Submit with breaker shop drawings, a copy of the purchase order to the distributor. Quantities, models and sizes shown on the purchase order shall correspond to those indicated on the shop drawings.

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. Installation shall be in accordance with the manufacturer's instructions, the CEC, as shown on the drawings, and as specified.
- 3.1.2. Fused switches shall be furnished complete with fuses. Arrange fuses such that rating information is readable without removing the fuses.
- 3.1.3. All disconnect switches and fuses supplied by the same manufacturer.
- 3.1.4. Safety switches in the circuit between a motor and a variable frequency drive shall be fitted with one type C auxiliary contact. Connect this contact to the variable frequency drive with two (2) # 14 AWG conductors inside a 12 mm (½") conduit.

3.2. MOLDED CASE CIRCUIT BREAKER

- 3.2.1. Install circuit breakers and connect as shown.
- 3.2.2. When a panel is replaced with a new one, the contractor shall verify the compatibility of the existing breakers with the new panel type. New breakers shall be supplied if the existing breakers are not compatible with the new panel and cannot be relocated.

3.3. FUSES

- 3.3.1. Install fuses in fuse holders just before energizing.
- 3.3.2. Ensure that fuses and holders are perfectly matched.
- 3.3.3. Ensure that the right fuse is used to protect the corresponding circuit.
- 3.3.4. Store the spare fuses in an orderly manner

3.4. IDENTIFICATION

- 3.4.1. Identify switches, as to equipment served, with engraved laminated phenolic name plates.

3.5. ACCEPTANCE CHECKS AND TESTS

3.5.1. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

3.5.2. Visual Inspection and Tests:

3.5.2.1. Compare equipment nameplate data with specifications and approved shop drawings.

3.5.2.2. Inspect physical, electrical, and mechanical condition.

3.5.2.3. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method.

3.5.3. Vacuum-clean enclosure interior. Clean enclosure exterior.

3.6. SPARE PARTS

3.6.1. Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fused disconnect switch installed on the project. Deliver to the Board representative.

TABLE OF CONTENTS

PART 1 - GENERAL	2
1.1. DESCRIPTION	2
1.2. RELATED WORK	2
1.3. QUALITY ASSURANCE	2
1.4. SUBMITTALS	2
1.5. APPLICABLE PUBLICATIONS	3
1.6. STANDARDS OF ACCEPTANCE	4
PART 2 - PRODUCTS	4
2.1. MOTOR STARTERS	4
2.2. COMBINATION MAGNETIC STARTER-FUSED/NON-FUSED DISCONNECT	6
PART 3 - EXECUTION	7
3.1. INSTALLATION	7
3.2. ACCEPTANCE CHECKS AND TESTS	8
3.3. FOLLOW-UP VERIFICATION	8
3.4. SPARE PARTS	8
3.5. INSTRUCTION	8

PART 1 - GENERAL

1.1. DESCRIPTION

- 1.1.1. This section specifies the furnishing, installation, connection, and testing of motor controllers, including all low-voltage motor controllers and manual motor controllers, indicated as motor controllers in this section.
- 1.1.2. Motor controllers, whether furnished with the equipment specified in other sections or otherwise (with the exception of fire pump controllers), shall meet this specification and all related specifications.

1.2. RELATED WORK

- 1.2.1. Section: 26 05 00 Common Work Results for Electrical.
- 1.2.2. Section: 26 05 19 Low-Voltage Electrical Power Conductors and Cables.
- 1.2.3. Section: 26 05 33 Raceway and Boxes for Electrical Systems.

1.3. QUALITY ASSURANCE

- 1.3.1. Refer to Section: 26 05 00 Common Work Results for Electrical.

1.4. SUBMITTALS

- 1.4.1. Submit documentation in accordance with Section: 26 05 00 Common Work Results for Electrical.
- 1.4.2. Shop Drawings:
 - 1.4.2.1. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - 1.4.2.2. Include electrical ratings, dimensions, weights, mounting details, materials, over current protection devices, overload relays, sizes of enclosures, wiring diagrams, starting characteristics, interlocking, and accessories.
- 1.4.3. Manuals:
 - 1.4.3.1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - 1.4.3.2. Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.
 - 1.4.3.3. Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.

- 1.4.3.4. Elementary schematic diagrams shall be provided for clarity of operation.
- 1.4.3.5. Include the catalog numbers for the correct sizes of overload relays for the motor controllers.
- 1.4.3.6. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
- 1.4.3.7. Certifications: Two weeks prior to final inspection, submit the following.
- 1.4.3.8. Certification by the manufacturer that the motor controllers conform to the requirements of the drawings and specifications.
- 1.4.3.9. Certification by the Contractor that the motor controllers have been properly installed, adjusted, and tested.

1.5. APPLICABLE PUBLICATIONS

- 1.5.1. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

- 1.5.1.1. CSA22.1 – Canadian Electrical Code part 1
- 1.5.1.2. UL® 198C - High-Interrupting Capacity Fuses; Current Limiting Type.
- 1.5.1.3. UL 198E - Class R Fuses.
- 1.5.1.4. NECA, "Standard of Installation" - published by National Electrical Contractors Association.
- 1.5.1.5. NEMA AB 1 - Molded Case Circuit Breakers.
- 1.5.1.6. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- 1.5.1.7. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- 1.5.1.8. NEMA KS 1 - Enclosed Switches.
- 1.5.1.9. Institute of Electrical and Electronic Engineers (IEEE):
 - 1.5.1.9.1. 519-92 Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
 - 1.5.1.9.2. C37.90.1-02 Standard Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
- 1.5.1.10. National Electrical Manufacturers Association (NEMA):
 - 1.5.1.10.1. ICS 1-08 Industrial Control and Systems: General Requirements
 - 1.5.1.10.2. ICS 1.1-09 Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
 - 1.5.1.10.3. ICS 2-05 Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 Volts
 - 1.5.1.10.4. ICS 4-05 Industrial Control and Systems: Terminal Blocks
 - 1.5.1.10.5. ICS 6-06 Industrial Control and Systems: Enclosures
 - 1.5.1.10.6. ICS 7-06 Industrial Control and Systems: Adjustable-Speed Drives

- 1.5.1.10.7. ICS 7.1-06 Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems
- 1.5.1.10.8. MG 1 Part 31 Inverter Fed Polyphase Motor Standards
- 1.5.1.11. National Fire Protection Association (NFPA):
 - 1.5.1.11.1. 70-11 National Electrical Code (NEC)
- 1.5.1.12. Underwriters Laboratories Inc. (UL):
 - 1.5.1.12.1. 508A-07 Industrial Control Panels
 - 1.5.1.12.2. 508C-07 Power Conversion Equipment
 - 1.5.1.12.3. UL 1449-06 Surge Protective Devices

1.6. STANDARDS OF ACCEPTANCE

- 1.6.1. Cutler Hammer
- 1.6.2. Square D/Schneider Electric
- 1.6.3. Siemens
- 1.6.4. Eaton Canada

PART 2 - PRODUCTS

2.1. MOTOR STARTERS

- 2.1.1. Starters shall be CSA and ULC approved. Motor controllers shall comply with IEEE, NEMA, NFPA, UL, and as shown on the drawings.
- 2.1.2. Starters shall be full voltage, non-reversing magnetic starters. Full protection is to be provided in the starters by means of one thermal overload relay per phase per starter with manual reset button to suit the service factor and acceleration time of the motor served.
- 2.1.3. Unless specified otherwise, motor starters shall be combination type, with magnetic controller and with circuit breaker, fused disconnect switch, motor circuit protector or disconnecting means, with external operating handle with lock-open padlocking positions and ON-OFF position indicator, as applicable to the project and as indicated on the drawings.
- 2.1.4. Starters shall be equipped with auxiliary contacts to satisfy interlocking and automatic control requirements, "Hand-Off-Automatic" switches, pilot lights (green-On; red-Off), thermal overloads, necessary fuses and control transformer (if required) for operation of all controls on 120V single phase.
- 2.1.5. Where required by applicable codes, starters shall be equipped with "quick-make" and "quick-break" fused disconnects.

2.1.6. Motor controllers shall be separately enclosed, unless part of another assembly. For installation in motor control centers, provide plug-in, draw-out type motor controllers up through NEMA size 4. NEMA size 5 and above require bolted connections.

2.1.7. Motor Circuit Protectors:

- 2.1.7.1. Magnetic trip only.
- 2.1.7.2. Bolt-on type with a minimum interrupting rating as indicated on the drawings.
- 2.1.7.3. Equipped with automatic, adjustable magnetic trip. Magnetic trip shall be adjustable up to 1300% of the motor full load amperes.

2.1.8. Enclosures:

- 2.1.8.1. Enclosures shall be NEMA-type rated 1, 3R, or 12 as indicated on the drawings or as required per the installed environment.
- 2.1.8.2. Enclosure doors shall be interlocked to prevent opening unless the disconnecting means is open. A "defeater" mechanism shall allow for inspection by qualified personnel with the disconnect means closed. Provide padlocking provisions.
- 2.1.8.3. All metal surfaces shall be thoroughly cleaned, phosphatized, and factory primed prior to applying light gray baked enamel finish.

2.1.9. Motor control circuits:

- 2.1.9.1. Shall operate at not more than 120 Volts.
- 2.1.9.2. Shall be grounded, except where the equipment manufacturer recommends that the control circuits be isolated.
- 2.1.9.3. For each motor operating over 120 Volts, incorporate a separate, heavy duty, control transformer within each motor controller enclosure.
- 2.1.9.4. Incorporate primary and secondary overcurrent protection for the control power transformers.

2.1.10. Overload relays:

- 2.1.10.1. Thermal type. Devices shall be NEMA type.
- 2.1.10.2. One for each pole.
- 2.1.10.3. External overload relay reset pushbutton on the door of each motor controller enclosure.
- 2.1.10.4. Overload relays shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
- 2.1.10.5. Thermal overload relays shall be tamperproof, not affected by vibration, manual reset, sensitive to single-phasing.

- 2.1.11. Incorporate into each control circuit a 120 Volt, electronic time-delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time-delay relay is not required where H O A switch is not required.
- 2.1.12. Unless noted otherwise, equip each motor controller with not less than two normally open (N.O.) and two normally closed (N.C.) auxiliary contacts.
- 2.1.13. Provide green (RUN) and red (STOP) pilot lights.
- 2.1.14. Motor controllers incorporated within equipment assemblies shall also be designed for the specific requirements of the assemblies.
- 2.1.15. Additional requirements for specific motor controllers, as indicated in other specification sections, shall also apply.

2.2. COMBINATION MAGNETIC STARTER-FUSED/NON-FUSED DISCONNECT

- 2.2.1. Description: Combine magnetic motor controllers as noted above with non-fusible or fusible switch disconnect in common enclosure (as specified and shown on the drawings). Switch shall have a color coded externally operated handle. Operating handle shall give positive visual indication of ON/OFF with red and black color-coding.
- 2.2.2. Non-fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle and visible blades. Operating handle shall give positive visual indication of ON/OFF with a color-coded operating handle.
- 2.2.3. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class [R] [J] fuses and visible blades. Operating handle shall give positive visual indication of ON/OFF with a color-coded operating handle.
- 2.2.4. Switch shall have fuse clips to accept time delay, one-time fuse, voltage as noted on the drawings, UL 198E, Class RK 1. Interrupting Rating: 200,000 rms amperes.
- 2.2.5. Magnetic Motor Controllers: NEMA ICS 2, ac general-purpose Class A magnetic controller for induction motors rated in horsepower.
- 2.2.6. Coil: Be of encapsulated type.
- 2.2.7. Poles: as indicated on the drawings and wiring schedules
- 2.2.8. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.
- 2.2.9. Wiring: Straight-through wiring with all terminals clearly marked.

2.2.10. Overload Relay: NEMA ICS

2.2.11. Melting Alloy: With one-piece thermal unit construction. Thermal units shall be interchangeable. Overload relay control circuit contact shall be replaceable. Thermal units shall be required for starter to operate.

2.2.12. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered, provide phase loss and phase unbalance protection, have a permanent tamper guard and be ambient insensitive. It will also be available in Trip Class 10 or 20 and have a mechanical test function.

2.2.13. Outputs: Unit will be designed for addition of either a normally open or normally closed

2.2.14. auxiliary contact and be field convertible.

2.2.15. Reset: Unit shall offer both manual reset and remote reset using an external module.

2.2.16. Enclosure: ANSI/NEMA ICS 6, Type 1 or 3R as required to meet conditions of installation.

2.2.17. Auxiliary Contacts: NEMA ICS 2 normally open and two normally closed contacts in addition to seal-in contact.

2.2.18. Cover Mounted Pilot Devices: NEMA ICS 2, standard duty type.

2.2.19. Pilot Device Contacts: NEMA ICS 2, Form Z, rated A150

2.2.20. Push Buttons: Unguarded Shrouded type.

2.2.21. Indicating Lights: incandescent type.

2.2.22. Selector Switches: Rotary type.

2.2.23. Relays: NEMA ICS 2.

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Install motor controllers in accordance with the CEC, NEC, as shown on the drawings, and as recommended by the manufacturer.

3.1.2. Install manual motor controllers in flush enclosures in finished areas. Select location to maintain handle at 1.5 m (5 ft) above the floor level.

3.1.3. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and electronic overload relay pickup and trip ranges.

- 3.1.4. Adjust trip settings of circuit breakers and motor circuit protectors with adjustable instantaneous trip elements (where applicable).

3.2. ACCEPTANCE CHECKS AND TESTS

- 3.2.1. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
 - 3.2.1.1. Visual Inspection and Tests:
 - 3.2.1.2. Compare equipment nameplate data with specifications and approved shop drawings.
 - 3.2.1.3. Inspect physical, electrical, and mechanical condition.
 - 3.2.1.4. Verify appropriate anchorage, required area clearances, and correct alignment.
 - 3.2.1.5. Verify that circuit breaker, motor circuit protector, and fuse sizes and types correspond to approved shop drawings.
 - 3.2.1.6. Verify overload relay ratings are correct.
 - 3.2.1.7. Vacuum-clean enclosure interior. Clean enclosure exterior.
 - 3.2.1.8. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
 - 3.2.1.9. Test all control and safety features of the motor controllers.
 - 3.2.1.10. For low-voltage variable speed motor controllers, final programming and connections shall be by a factory-trained technician. Set all programmable functions of the variable speed motor controllers to meet the requirements and conditions of use.

3.3. FOLLOW-UP VERIFICATION

- 3.3.1. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the motor controllers are in good operating condition and properly performing the intended functions.

3.4. SPARE PARTS

- 3.4.1. Two weeks prior to the final inspection, provide one complete set of spare fuses for each motor controller.

3.5. INSTRUCTION

- 3.5.1. Furnish the services of a factory trained technician for two 4 hour training periods for instructing personnel in the maintenance and operation of the motor controllers, on the dates requested by the Board.

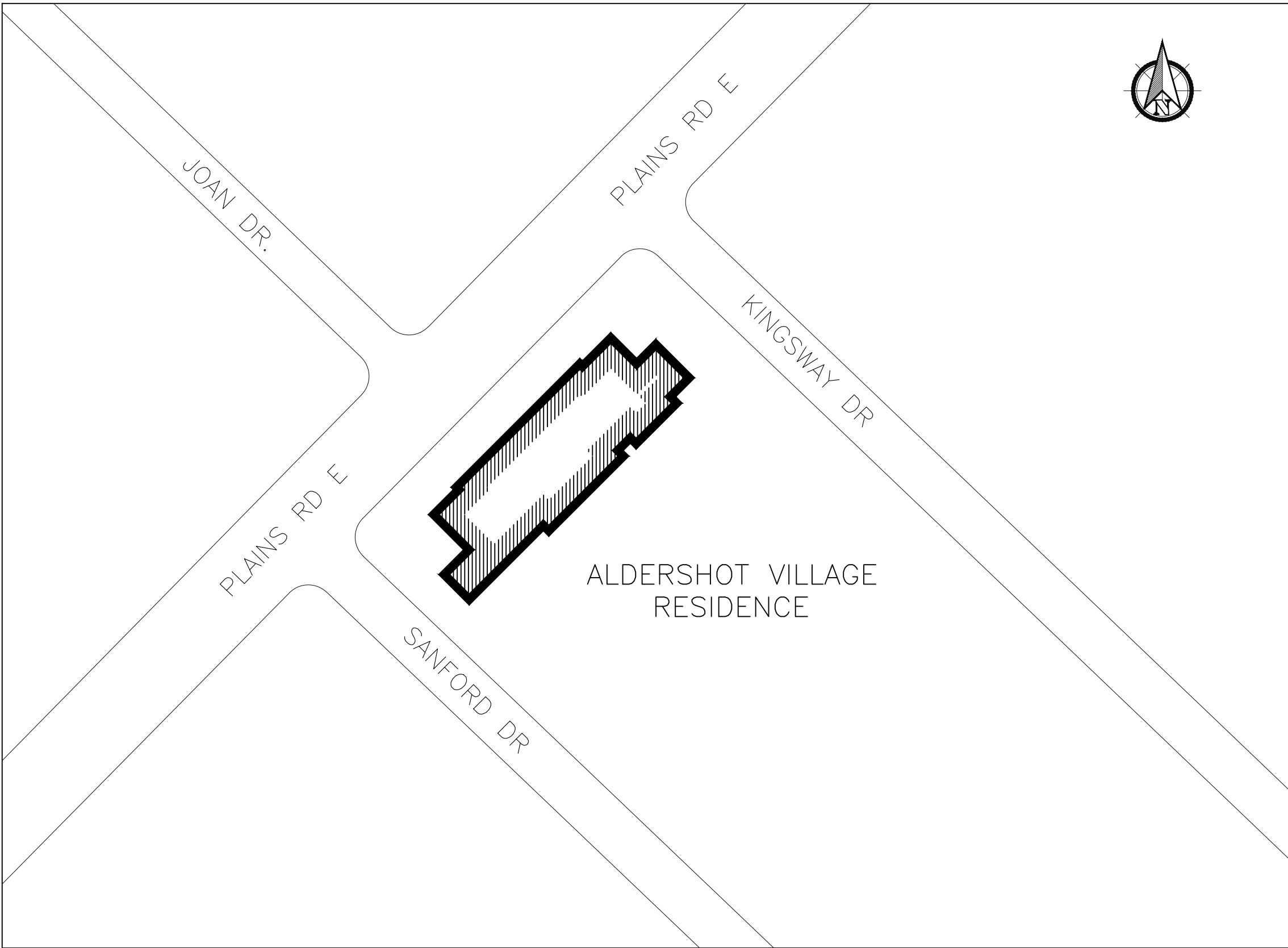
ATTACHMENT B

TECHNICAL DRAWINGS

HALTON COMMUNITY HOUSING CORPORATION
ALDRESHOT VILLAGE RESIDENCE
HEAT PUMP UPGRADES

540 PLAINS RD E.,
BURLINGTON, ON L7T 2E3

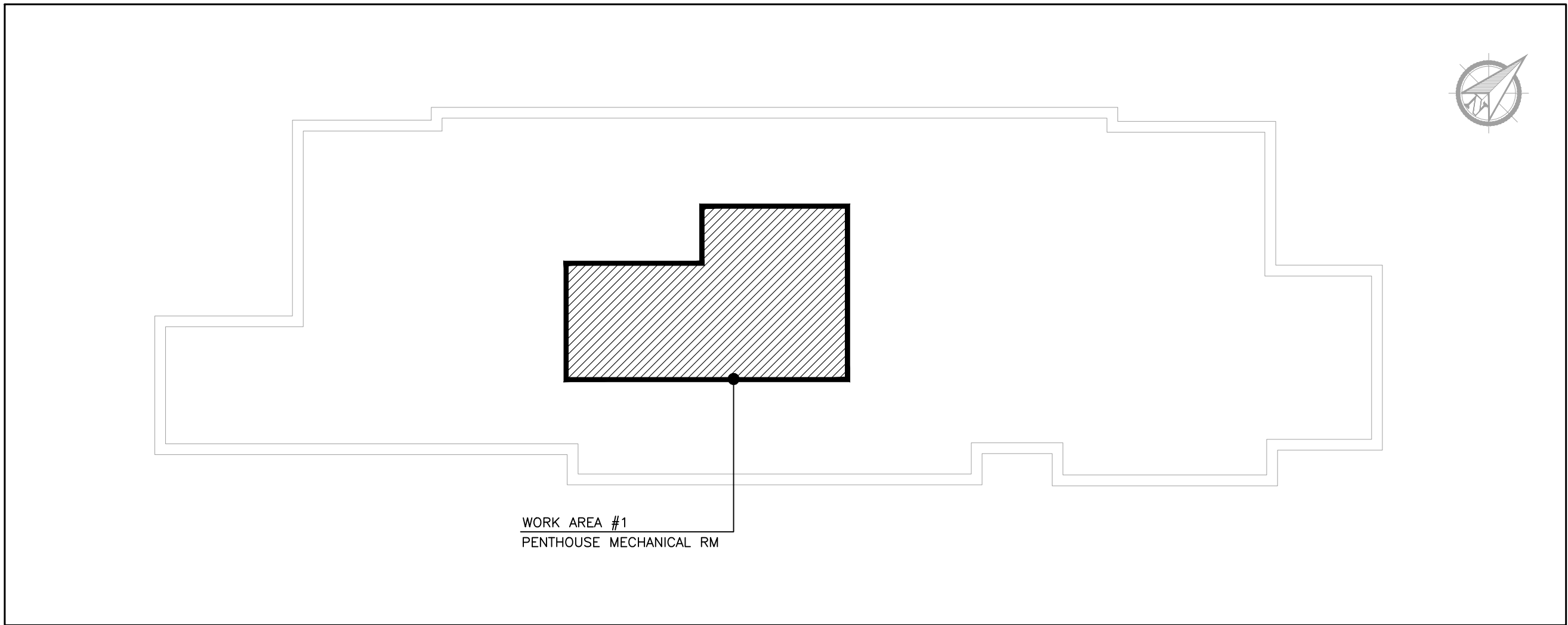
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APRIL 2026



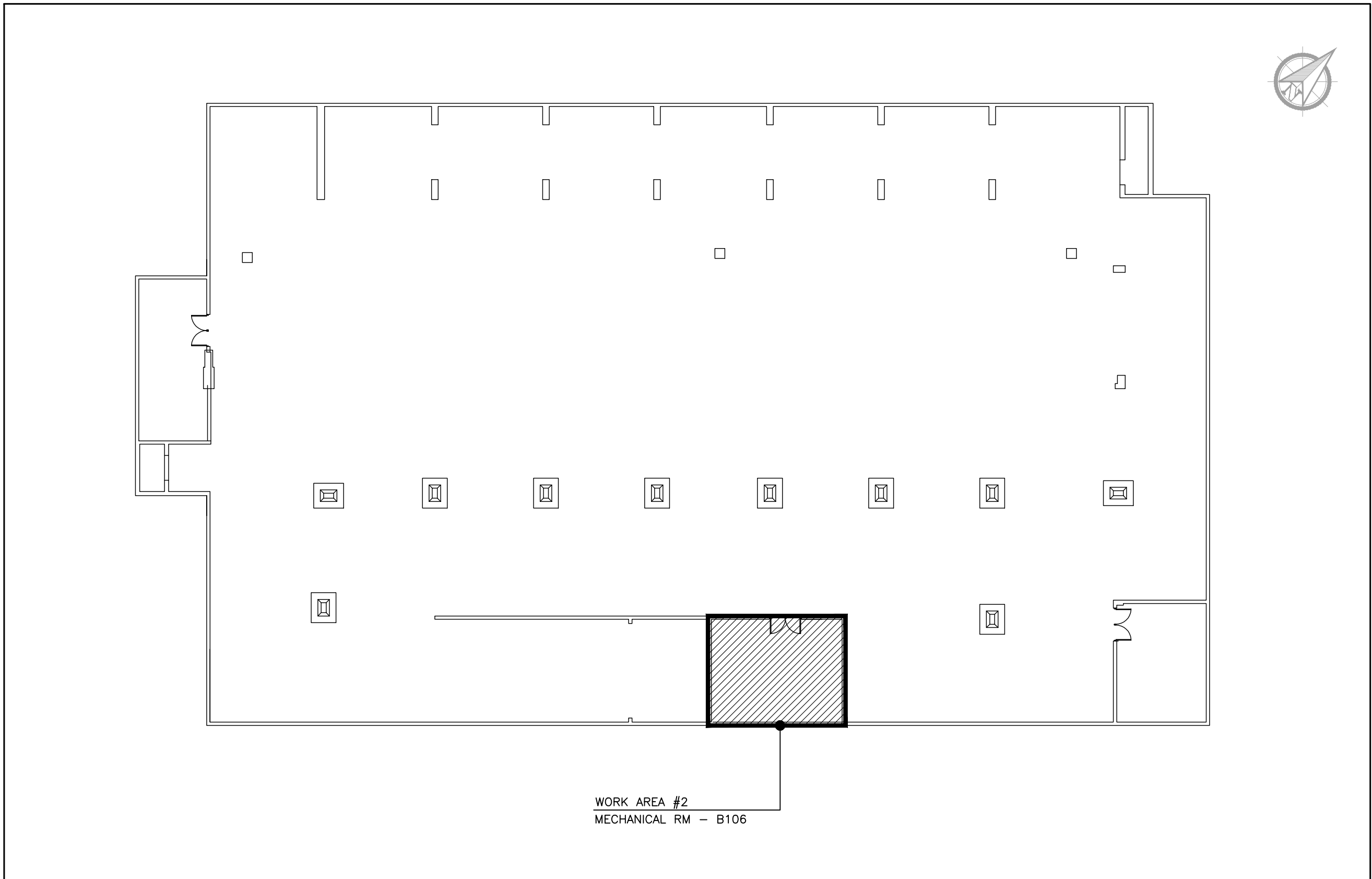
DRAWING LIST

NO.	DRAWING TITLE
M-1	KEY PLANS, SYMBOLS & EQUIPMENT SCHEDULES
M-2	PENTHOUSE MECHANICAL ROOM – HVAC – EXISTING & DEMOLITION WORK
M-3	MECHANICAL ROOM B106 – HVAC – EXISTING & DEMOLITION WORK
M-4	PENTHOUSE MECHANICAL ROOM – HVAC – NEW WORK
M-5	MECHANICAL ROOM B106 – HVAC – NEW WORK
E-1	KEY PLAN, LEGENDS, GENERAL NOTES, DETAILS & EQUIPMENT WIRING SCHEDULES
E-2	PENTHOUSE MECHANICAL ROOM – POWER PLAN
E-3	MECHANICAL ROOM B106 – POWER PLAN

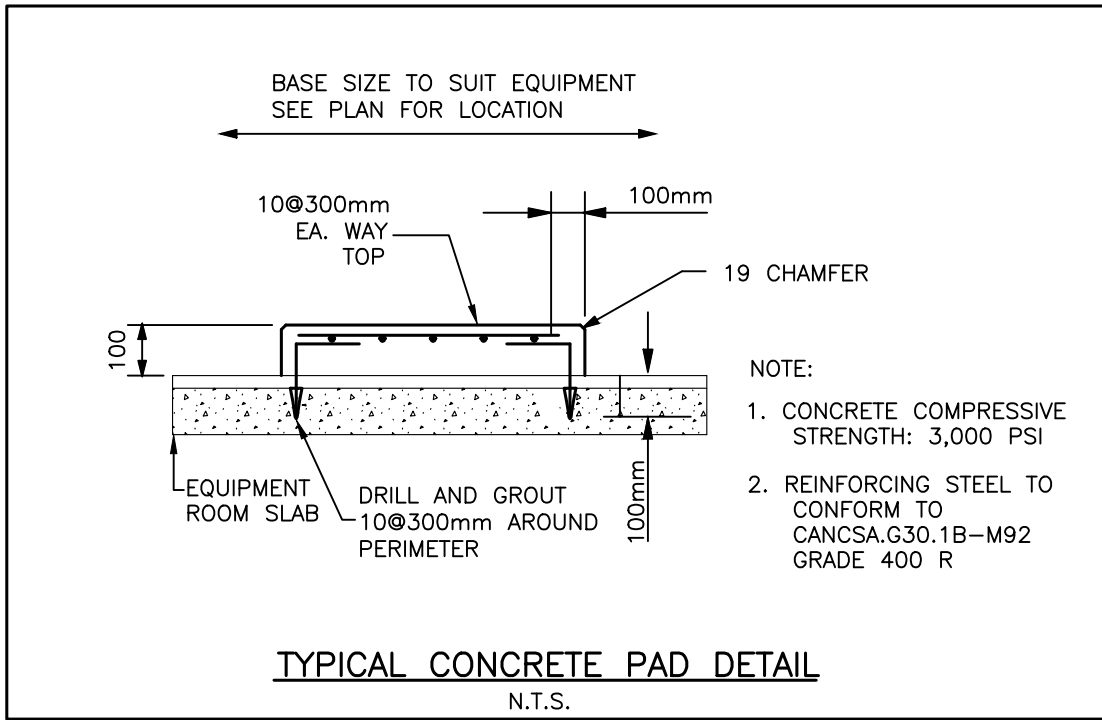
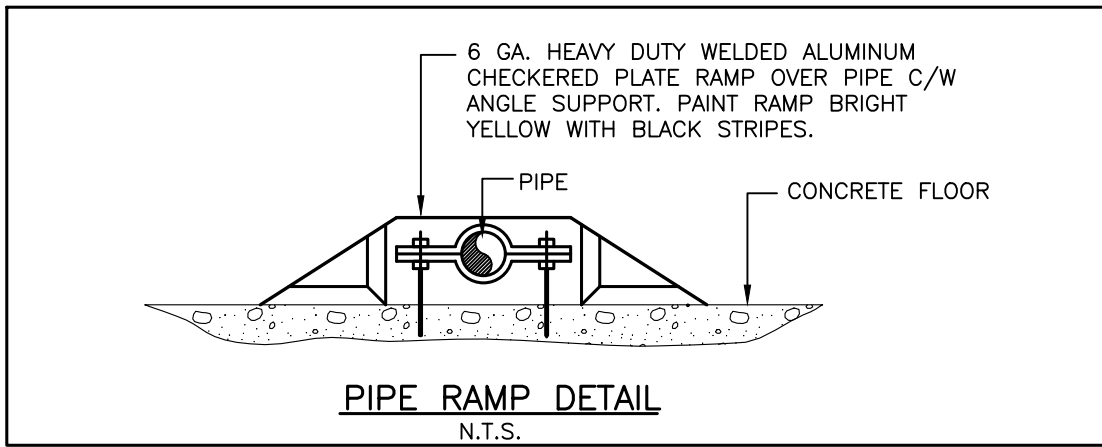
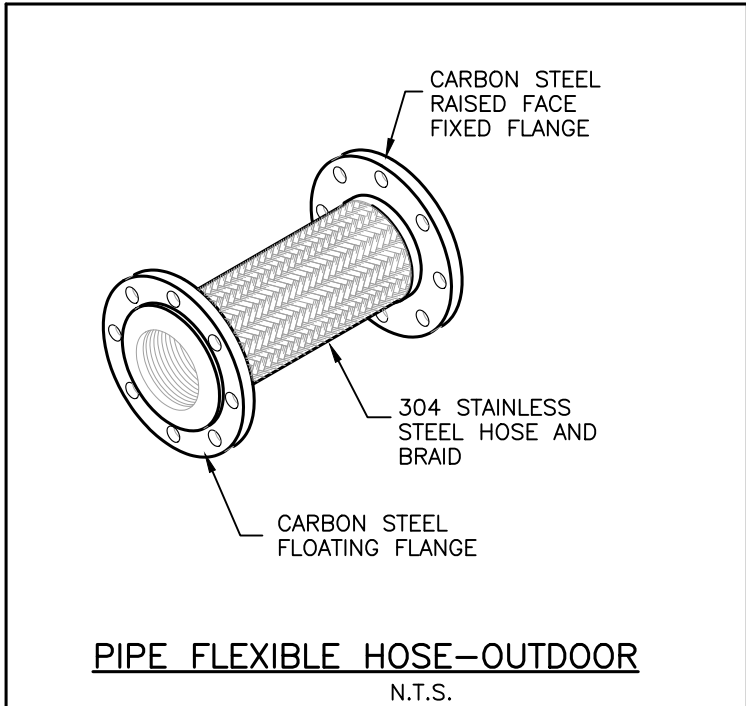
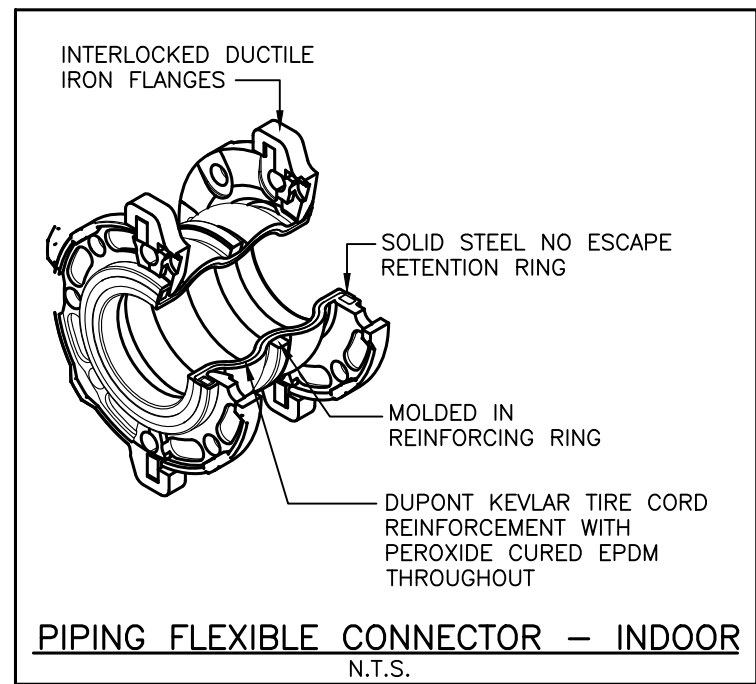
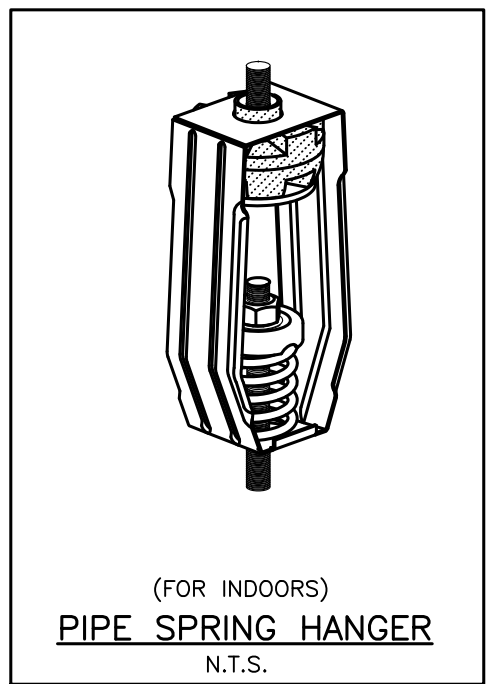
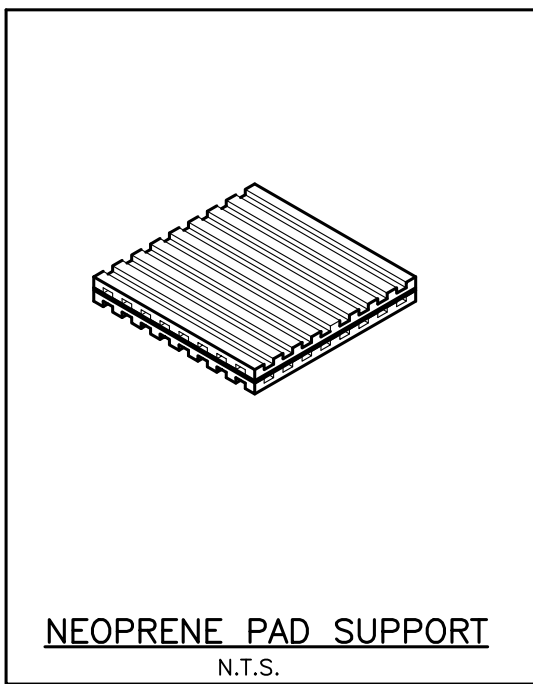
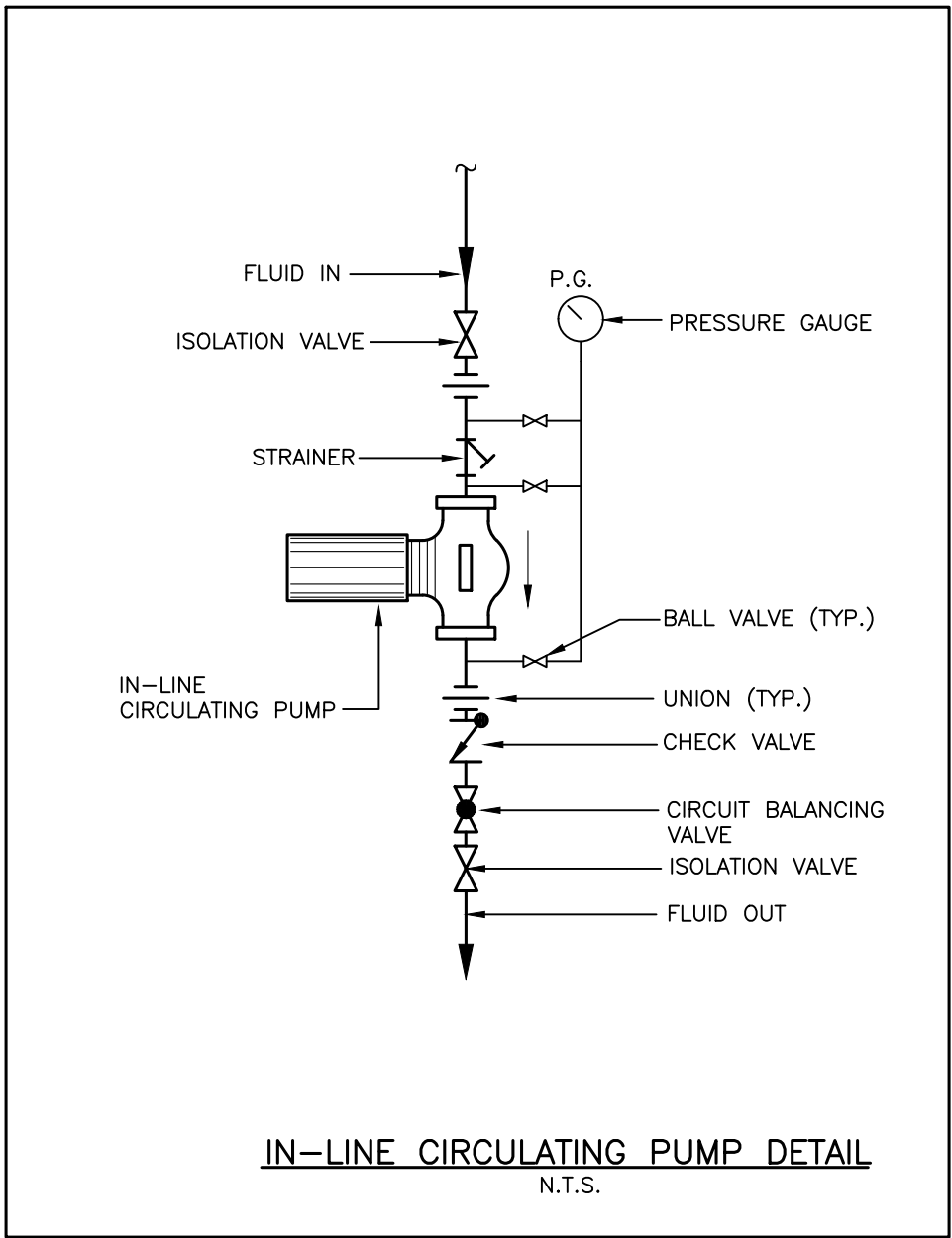




KEY PLAN -- ROOF
N.T.S.



KEY PLAN -- UNDERGROUND PARKING LEVEL
N.T.S.



MECHANICAL SYMBOLS	
	DOMESTIC COLD WATER SUPPLY
	DOMESTIC HOT WATER SUPPLY
	GLYCOL HTG. SUPPLY
	GLYCOL HTG. RETURN
	HEAT PUMP SUPPLY
	HEAT PUMP RETURN
	PIPE TURNING DOWN
	PIPE TURNING UP
	FLOOR DRAIN/ FUNNEL FLOOR DRAIN
CTE	DENOTES: CONNECT TO EXISTING
CUT	DENOTES: CUT POINT OF EXISTING SERVICE
	DENOTES: EQUIPMENT OR PIPING TO BE REMOVED
	UNION
	AUTOMATIC AIR VENT
	PUMP
	CONTROL VALVE -- TWO WAY
	MIXING OR DIVERTING CONTROL VALVE (3-WAY)
	ISOLATION VALVE
	BALANCING VALVE
	CHECK VALVE
	STRAINER -- OVER 50mm PROVIDE WITH VALVED FLUSHING DRAIN
	THERMOMETER
	PRESSURE GAUGE
	SHEET METAL DUCT -- FIRST FIGURE INDICATES DIMENSION SHOWN
	SHEET METAL RISER UP -- SUPPLY
	SHEET METAL RISER UP -- RETURN AND EXHAUST
	SHEET METAL RISER DOWN -- SUPPLY
	SHEET METAL RISER DOWN -- RETURN AND EXHAUST
	SQUARE ELBOW WITH AIR TURNING VANES
	FUSIBLE LINK FIRE DAMPER WITH ACCESS DOOR IN DUCT
	MOTORIZED DAMPER WITH ACCESS DOOR IN DUCT
	BALANCING DAMPER
	FLEXIBLE DUCT CONNECTION

REVISION NO.

No.	DATE	DESCRIPTION
1.	19/12/2025	ISSUED FOR 50% REVIEW
2.	19/03/2026	ISSUED FOR TENDER
3.	04/05/2026	ISSUED FOR TENDER

THE CONTRACTOR MUST VERIFY ALL DIMENSIONS ON AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

DO NOT SCALE DRAWINGS.

SEAL



NORTH

TRUE NORTH

CONSULTANT



588 EDWARD AVE., UNIT 25, RICHMOND HILL, ONT., L4C 9Y6
TEL. (905)-787 8885 FAX (905)-787 8771

PROJECT

HEAT PUMP UPGRADES
540 PLAINS ROAD E.
BURLINGTON, ONTARIO L7T 2E3

DRAWING TITLE

KEY PLAN, SYMBOLS LIST,
EQUIPMENT SCHEDULES & DETAILS

DATE

DEC. 25

DRAWN BY

H.T.

JOB No.

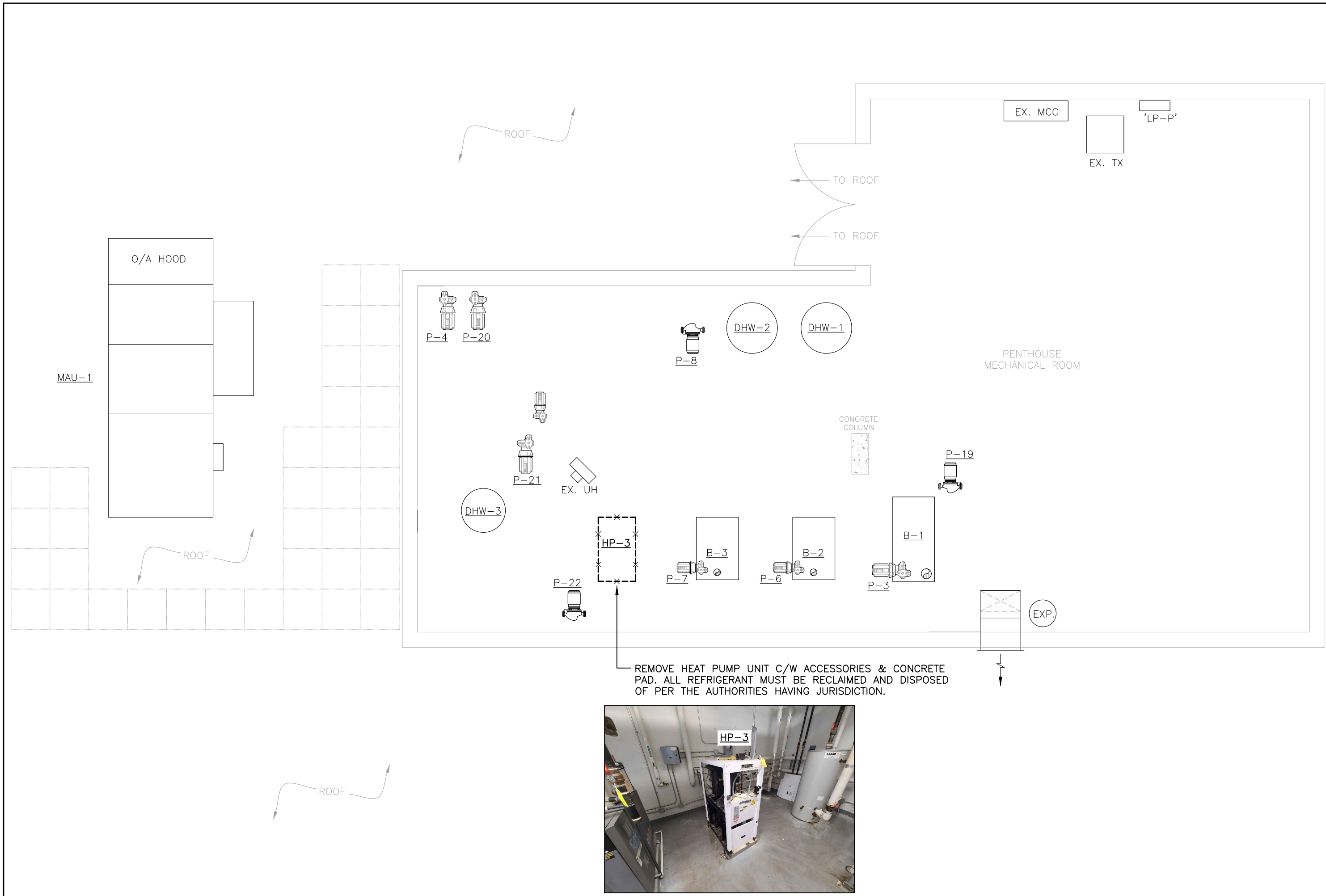
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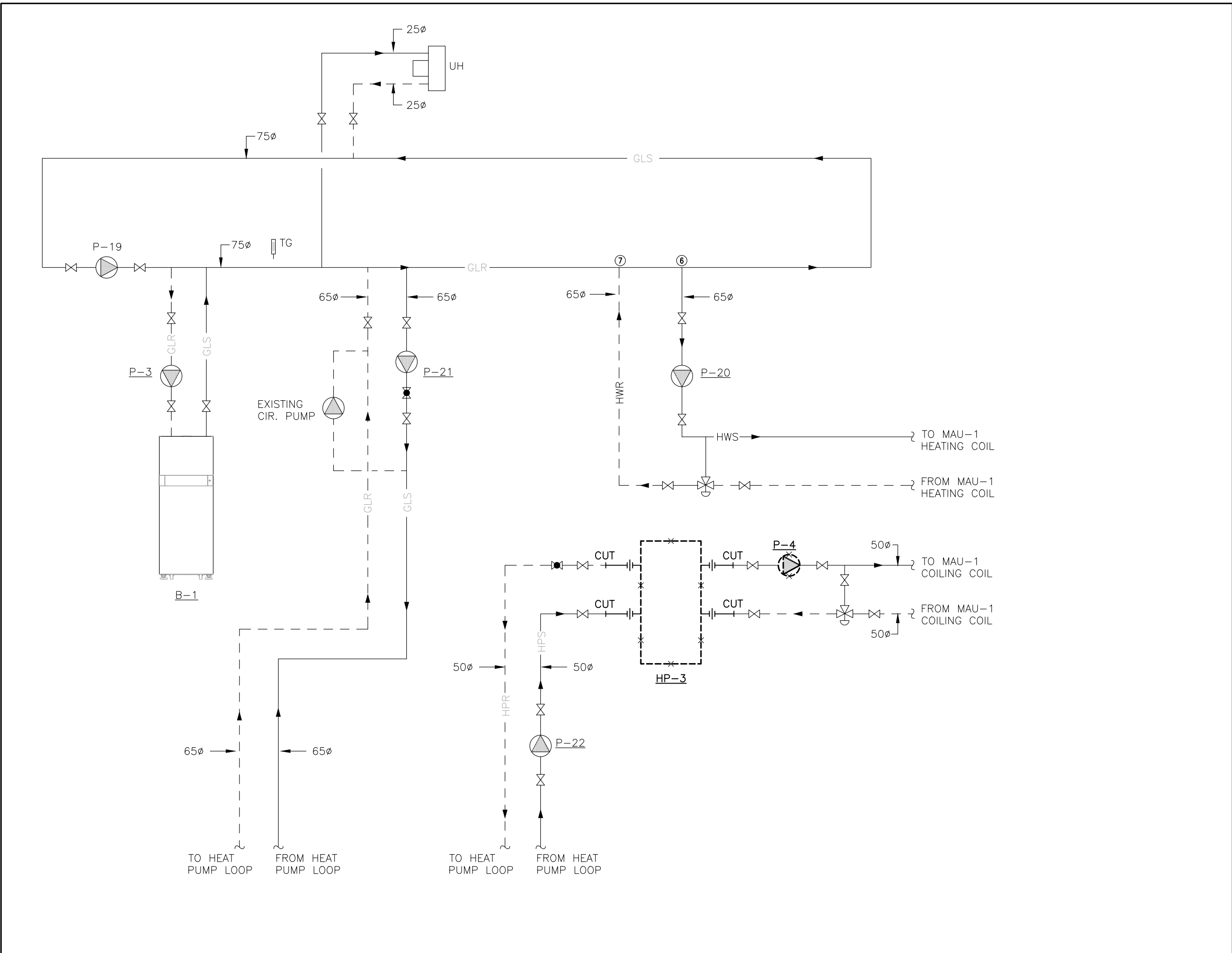
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DWG. No.

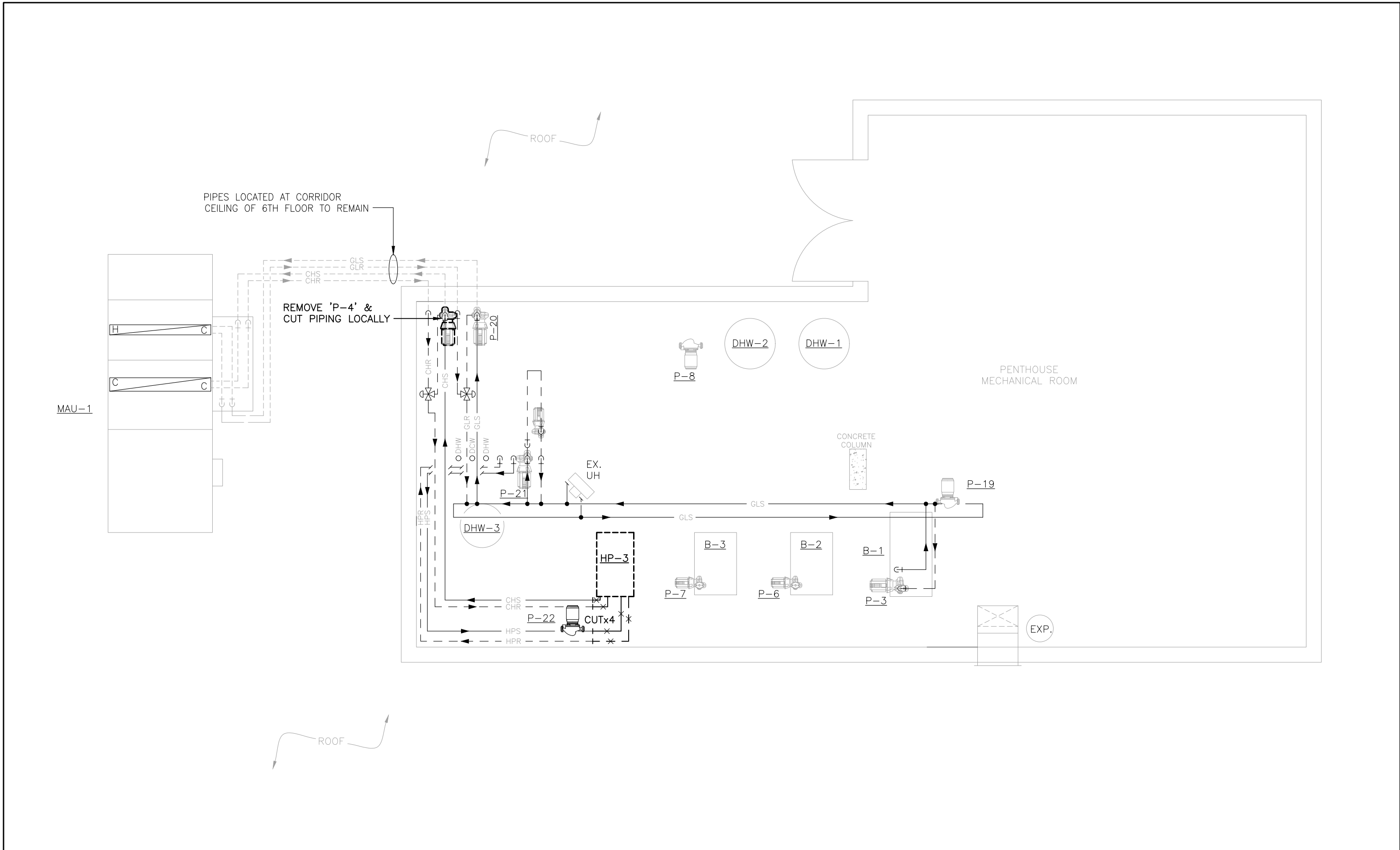
M-1



PENTHOUSE MECHANICAL RM LAYOUT – EXISTING & DEMOLITION WORK
SCALE: 1:50



PENTHOUSE MECHANIC RM – PIPING SCHEMATIC DIAGRAM – EXISTING & DEMOLITION WORK
SCALE: NTS



PENTHOUSE MECHANICAL RM – PIPING LAYOUT – EXISTING & DEMOLITION WORK
SCALE: 1:50

GENERAL DEMOLITION NOTES:

THESE NOTES SHALL BE READ IN CONJUNCTION WITH, AND SHALL FORM AN INTEGRAL PART OF THE SPECIFICATIONS.

THE DRAWING ONLY SHOWS PIPING DIRECTLY AFFECTED BY THIS PROJECT. OTHER PIPING SYSTEMS RELATED TO DHW, DCW AND OTHER SYSTEMS ARE NOT SHOWN. PRIOR TO COMMENCING THE DEMOLITION WORK, EXAMINE CAREFULLY THE ELEMENTS OF THE EXISTING SYSTEMS TO BE REMOVED. FOR REASONS OF CLARITY, THE DRAWINGS DO NOT SHOW ALL BUILDING SERVICES LOCATED IN THE MECHANICAL ROOM OR ALL STRUCTURAL ELEMENTS. ALL BUILDING SERVICES AND OTHER UTILITIES NOT AFFECTED BY THIS WORK SHALL REMAIN OPERATIONAL. ANY DAMAGE TO BUILDING SERVICES AND UTILITIES NOT AFFECTED BY THE WORK SHALL BE PROMPTLY REPAIRED BY THE CONTRACTOR, AT NO COST TO THE OWNER.

THE SIZES AND LOCATION OF PIPING, DUCTWORK, EQUIPMENT AND OTHER UTILITIES INDICATED ON THE DRAWINGS WERE SITE MEASURED OR TAKEN FROM EXISTING DRAWINGS. MAKE ANY CHANGES REQUIRED TO SUIT THE ACTUAL SITE CONDITIONS AT NO COST TO THE OWNER.

REMOVE HEAT PUMP UNIT AS INDICATED, INCLUDING FITTINGS AND ACCESSORIES. DISCONNECT FROM POWER AND CONTROLS

ENSURE THAT DURING THE DEMOLITION WORK, THE FLOOR DRAINS ARE PROTECTED AGAINST CLOGGING WITH DEBRIS. REMOVE ALL REDUNDANT PIPE HANGERS AND SUPPORTS.

THE CONTROL CONTRACTOR IS RESPONSIBLE FOR THE DEMOLITION OF ALL THE CONTROLS ASSOCIATED WITH THE EQUIPMENT TO BE REMOVED, INCLUDING SENSORS, DEVICES, (PRESSURE SENSORS, HUMIDITY AND TEMPERATURE SENSORS). TUBING AND WIRING. CONTRACTOR TO IDENTIFY ALL EXISTING WIRING PRIOR TO DEMOLITION TO ENSURE THAT ALL EXISTING EQUIPMENT THAT IS TO REMAIN WILL NOT BE AFFECTED BY THIS WORK AND SHALL REMAIN OPERATIONAL AND UNCONTAMINATED BY OIL OR DEBRIS. REMOVE ALL EXITING CONTROL PANELS THAT ARE REDUNDANT.

ALLOW FOR DRAINING OF THE EXISTING HEATING SYSTEM, AS NECESSARY TO PERFORM THE WORK. DISPOSE OF ANY GLYCOL IN ACCORDANCE WITH THE CURRENT ENVIRONMENTAL BY-LAWS.

CONTRACTOR IS RESPONSIBLE FOR DISPOSAL OF ALL REMOVED EQUIPMENT AND MATERIALS.

PREPARE THE FLOOR FOR POURING OF NEW CONCRETE PAD. ENSURE THAT DURING THE DEMOLITION WORK, THE FLOOR DRAINS ARE PROTECTED AGAINST CLOGGING WITH DEBRIS. REMOVE ALL REDUNDANT PIPE HANGERS AND SUPPORTS.

REVISION NO.

No.	DATE	DESCRIPTION
1.	19/12/2025	ISSUED FOR 50% REVIEW
2.	19/03/2026	ISSUED FOR TENDER
3.	04/05/2026	ISSUED FOR TENDER

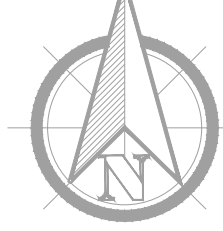
THE CONTRACTOR MUST VERIFY ALL DIMENSIONS ON AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.

DO NOT SCALE DRAWINGS.

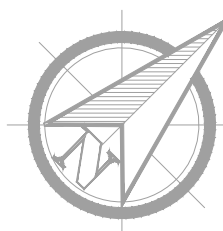
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PROJECT

HEAT PUMP UPGRADES
540 PLAINS ROAD E.
BURLINGTON, ONTARIO L7T 2E3

DRAWING TITLE

PENTHOUSE MECHANICAL ROOM
– HVAC – EXISTING &
DEMOLITION WORKS

DATE

DEC. 25

DRAWN BY

H.T.

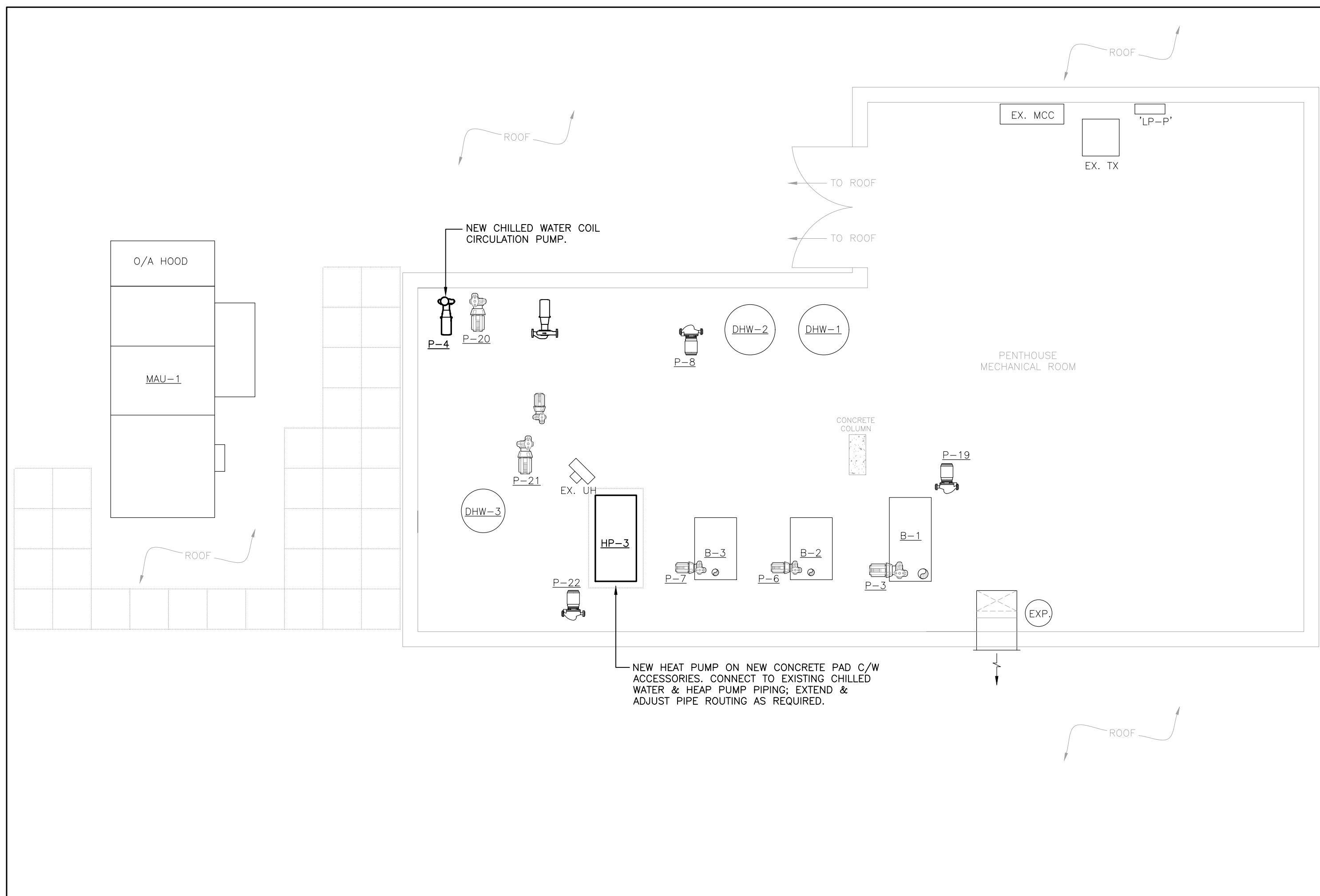
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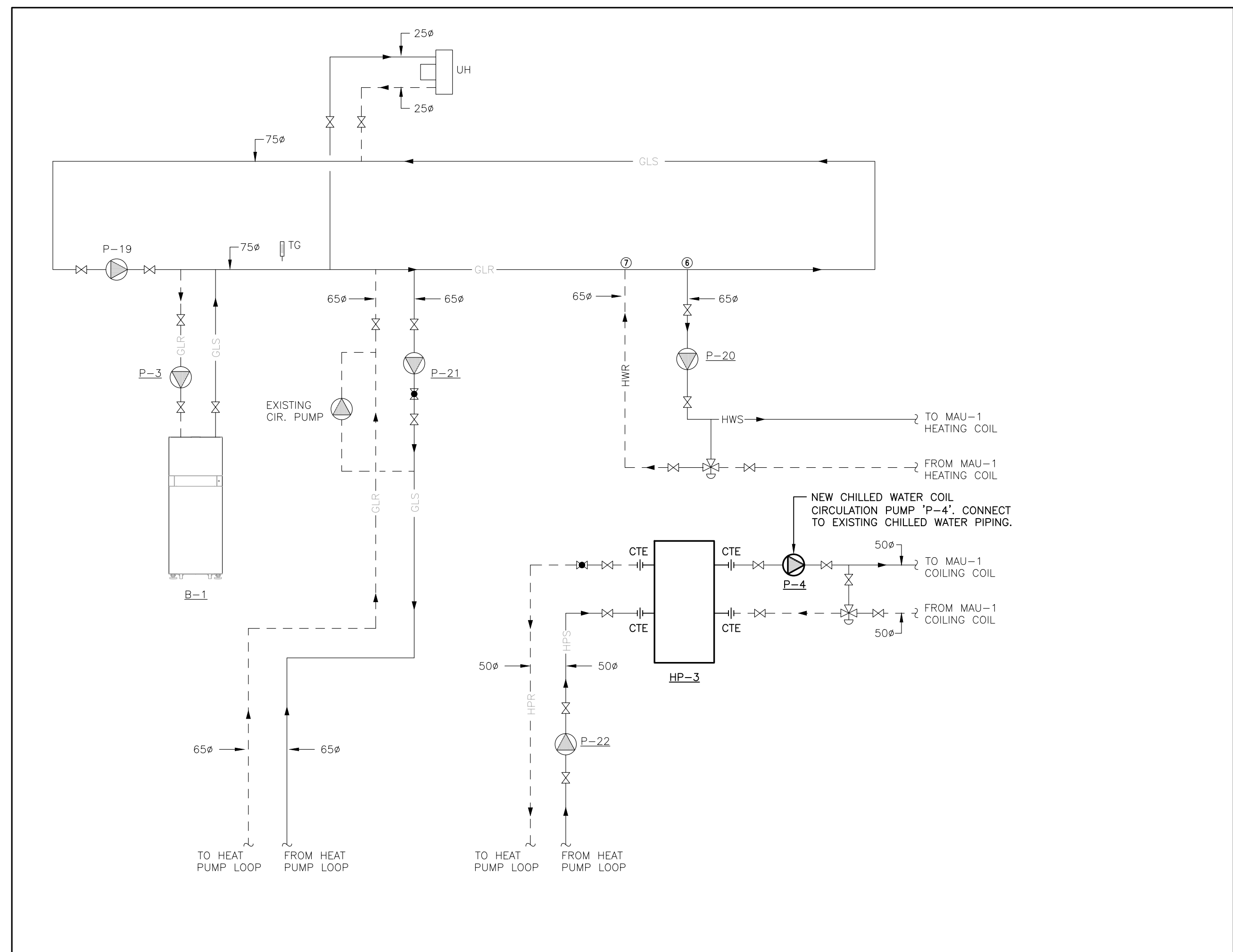
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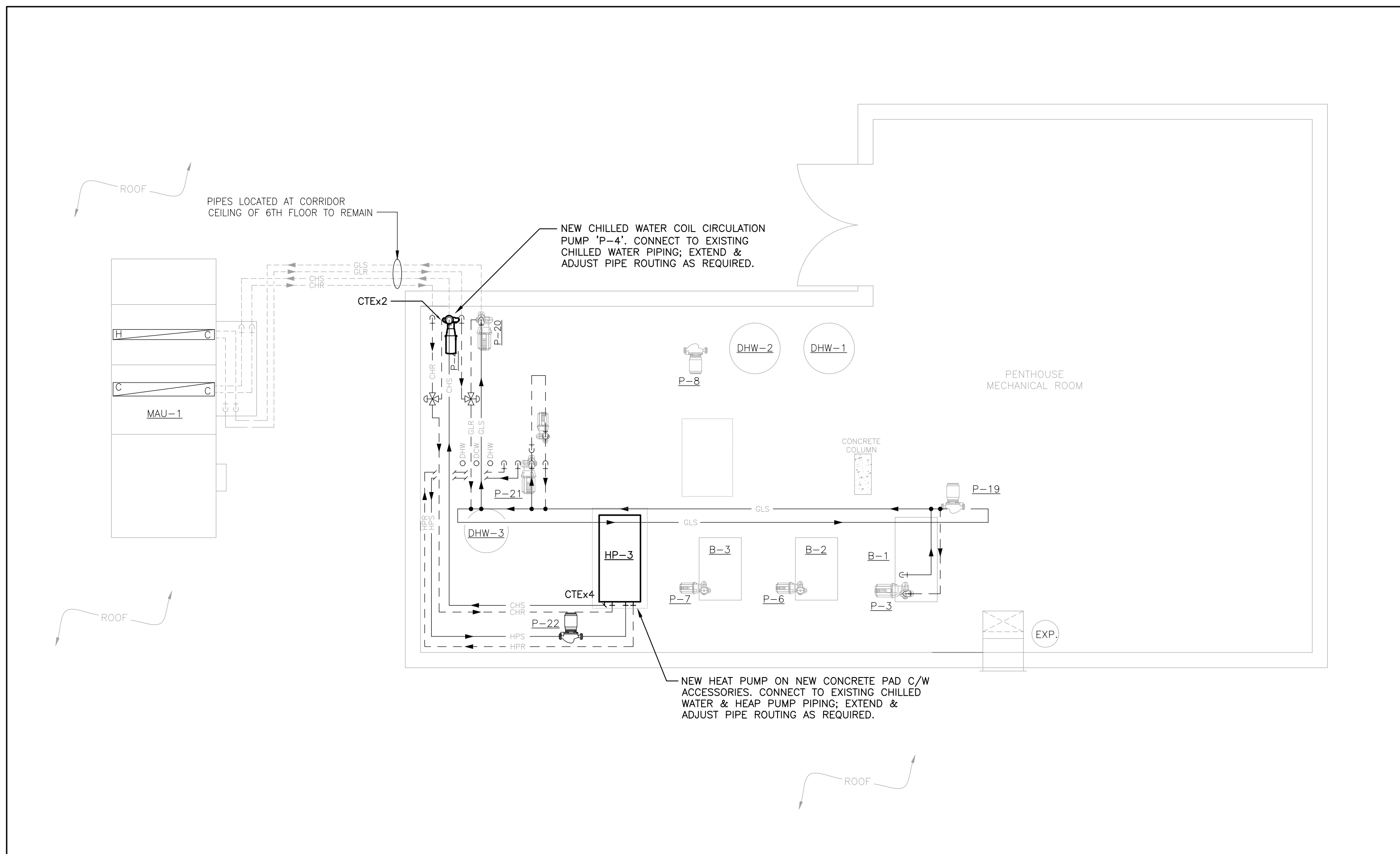
M-2



PENTHOUSE MECHANICAL RM LAYOUT – NEW WORK
SCALE: 1:50



PENTHOUSE MECHANIC RM – PIPING SCHEMATIC DIAGRAM – NEW WORK
SCALE: NTS



PENTHOUSE MECHANICAL RM – PIPING LAYOUT – NEW WORK
SCALE: 1:50

NEW WORK NOTES:

THESE NOTES SHALL BE READ IN CONJUNCTION WITH, AND SHALL FORM AN INTEGRAL PART OF THE SPECIFICATIONS.

FOR REASONS OF CLARITY, THE LAYOUT DRAWINGS DO NOT SHOW ALL VALVES, FITTINGS AND SENSORS/GAUGES. FOR FULL EXTENT OF FITTINGS AND INSTRUMENTATION, REFER TO THE NEW PIPING SCHEMATIC AND CONTROLS DIAGRAMS. THE DRAWINGS DO NOT SHOW ALL STRUCTURAL ELEMENTS AND BUILDING SERVICES LOCATED IN THE BOILER ROOM. INSTALL THE NEW PIPING SUCH AS TO AVOID INTERFERENCE WITH THE EXISTING BUILDING SERVICES AND OTHER UTILITIES LOCATED IN THE ROOM. RELOCATE EXISTING SERVICES IF SO REQUIRED TO ACCOMMODATE THE NEW PIPING AND EQUIPMENT, AT NO ADDITIONAL COST TO THE OWNER.

THE SIZE AND LOCATION OF EXISTING PIPING HAS BEEN SITE MEASURED. MAKE ANY CHANGES REQUIRED TO CONNECT TO THE EXISTING PIPING WITHOUT ADDITIONAL COST TO THE OWNER. ALL LOCATIONS WHERE EXISTING PIPES CONNECT TO NEW ARE APPROXIMATE; EXACT LOCATIONS TO BE ESTABLISHED ON SITE.

PROVIDE THE NECESSARY POWER SUPPLY TO THE NEW PUMPS, INCLUDING WIRING, CONDUITS, DISCONNECT SWITCHES AND VFDs/STARTERS. MOUNT THE NEW ELECTRICAL DEVICES AS SHOWN ON THE ELECTRICAL DRAWINGS. MAINTAIN THE CODE-PRESCRIBED CLEARANCES. ALSO REFER TO THE ELECTRICAL DRAWINGS.

PROVIDE POWER TO ALL NEW AND EXISTING CONTROL DEVICES, SENSORS AND OPERATORS; PROVIDE STEP-DOWN TRANSFORMERS AS REQUIRED, INCLUDING ALL LINE-VOLTAGE AND LOW-VOLTAGE WIRING AND CONDUITS.

PROVIDE NEW CONCRETE PAD FOR ALL NEW EQUIPMENT. ALL PADS SHALL EXCEED THE FOOTPRINT OF THE EQUIPMENT BY A MINIMUM OF 100MM ON EACH SIDE. PROTECT THE EXISTING FLOOR DRAINS. REPAIR FLOOR AND PAINT THE ENTIRE BOILER ROOM FLOOR WITH BATTLESHIP GRAY COLOR EPOXY PAINT, PREPARE SURFACE ACCORDINGLY PRIOR TO PAINTING. ENSURE THAT THE NEW PADS DON'T INTERFERE WITH THE PATH OF DRAINAGE TO THE FLOOR DRAINS.

PIPE ALL DRAINS, PRESSURE RELIEF DEVICES TO FLOOR DRAINS. WHERE PIPING ON THE FLOOR REPRESENTS A TRIPPING HAZARD, PROVIDE CHECKERED ALUMINUM COVERS.

ENSURE THAT ALL ISOLATION AND CONTROL VALVES, STRAINERS ARE ACCESSIBLE FOR MAINTENANCE, ENSURE THAT READING OF ALL ANALOGUE GAUGES IS POSSIBLE FROM THE FLOOR. ALL GAS ISOLATION VALVES TO BE ACCESSIBLE.

SUPPLY AND INSTALL NEW PIPING AS INDICATED ON THE DRAWINGS AND SCHEMATIC AND AS REQUIRED TO HAVE A COMPLETE WORKING SYSTEM. INSULATE ALL NEW PIPING AS PER SPECIFICATIONS. EXACT ROUTING OF PIPING TO BE DETERMINED ON SITE BY THE CONTRACTOR.

SUPPORT NEW PIPING AND EQUIPMENT FROM FLOOR OR CEILING, AS WARRANTED BY EXISTING STRUCTURE AND LOCAL CONDITIONS. CONTRACTOR TO PROVIDE AND INSTALL CUSTOM STEEL SUPPORTS AS REQUIRED FOR SUPPORTING ALL PIPING AND EQUIPMENT. ANCHOR ALL SUPPORTS TO THE FLOOR, WALLS OR STRUCTURAL CEILING SLAB. IF THE EXISTING CEILING CONTAINS ASBESTOS, THE CEILING WILL NOT BE REMOVED. ALL SUPPORTS TO BE FROM THE FLOOR OR WALLS.

FOR HP-1 AND HP-2, AT THE CONCLUSION OF THE WORK, REFILL THE HEATING WATER LOOPS ON BOTH THE SOURCE SIDE AND LOAD SIDE, COMPLETELY DEAEERATE THE SYSTEM, FLUSH ALL PIPING AS SPECIFIED, AND PROVIDE CHEMICAL TREATMENT.

FOR HP-3, AT THE CONCLUSION OF THE WORK, REFILL THE CHILLED WATER LOOPS ON BOTH THE SOURCE SIDE AND LOAD SIDE, COMPLETELY DEAEERATE THE SYSTEM, FLUSH ALL PIPING AS SPECIFIED, AND PROVIDE CHEMICAL TREATMENT.

BAS SEQUENCE OF OPERATION

1. THE EXISTING MAKE-UP AIR WILL OPERATE AS PER THE CURRENT SEQUENCE OF OPERATION. THE REPLACED HP-3 AND ASSOCIATED PUMPS TO BE RECONNECTED TO THE EXISING BAS SYSTEM.
2. **OUTDOOR TEMPERATURE ABOVE 24°C:** THE COOLING HEAT PUMP HP-3 AND ASSOCIATED PUMP P-22 SHALL BE ENERGIZED. PUMP P-4 SHALL START AND RUN CONTINUOUSLY. ON A CALL FOR COOLING FROM THE MAKE-UP AIR UNIT DISCHARGED AIR SENSOR, PUMP P-22 SHALL START; UPON CONFIRMATION THAT P-22 IS RUNNING, HEAT PUMP HP-3 SHALL START AND SHALL MODULATE AS REQUIRED TO MAINTAIN THE FLUID FEEDING THE MAKE-UP AIR UNIT COOLING COIL AT 12°C. THE COOLING 3-WAY MIXING VALVE SHALL MODULATE AS REQUIRED TO MAINTAIN THE AIR DISCHARGED BY THE MAKE-UP AIR UNIT AT 18°C. UPON REACHING THE DISCHARGED AIR SETPOINT, THE HEAT PUMP HP-3 AND ASSOCIATED PUMP P-22 SHALL STOP. PUMP P-4 SHALL CONTINUE TO RUN.
3. **OUTDOOR TEMPERATURE BETWEEN 24°C AND 18°C:** THE HEAT PUMP HP-3, THE ASSOCIATED PUMPS P-4 AND P-22 SHALL BE DE-ENERGIZED. THE COOLING 3-WAY MIXING VALVE SHALL RETURN TO ITS DEFAULT POSITION. THE SUPPLY FAN SHALL CONTINUE TO RUN AS NOTED.
4. PROVIDE ALL REQUIRED WIRING, DEVICES AND RELAYS FOR FULL INTEGRATION OF EQUIPMENT CONTROLS WITH THE EXISTING BAS.
5. UPGRADE THE GRAPHICAL INTERPHASE AS REQUIRED.

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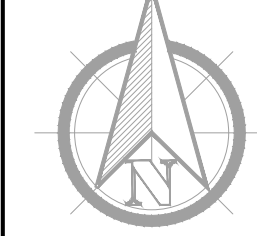
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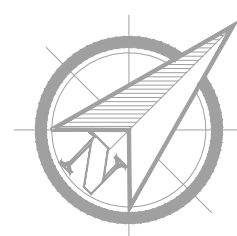
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PROJECT

HEAT PUMP UPGRADES
540 PLAINS ROAD E.
BURLINGTON, ONTARIO L7T 2E3

DRAWING TITLE

PENTHOUSE MECHANICAL ROOM
– HVAC – NEW WORKS

DATE

DEC. 25

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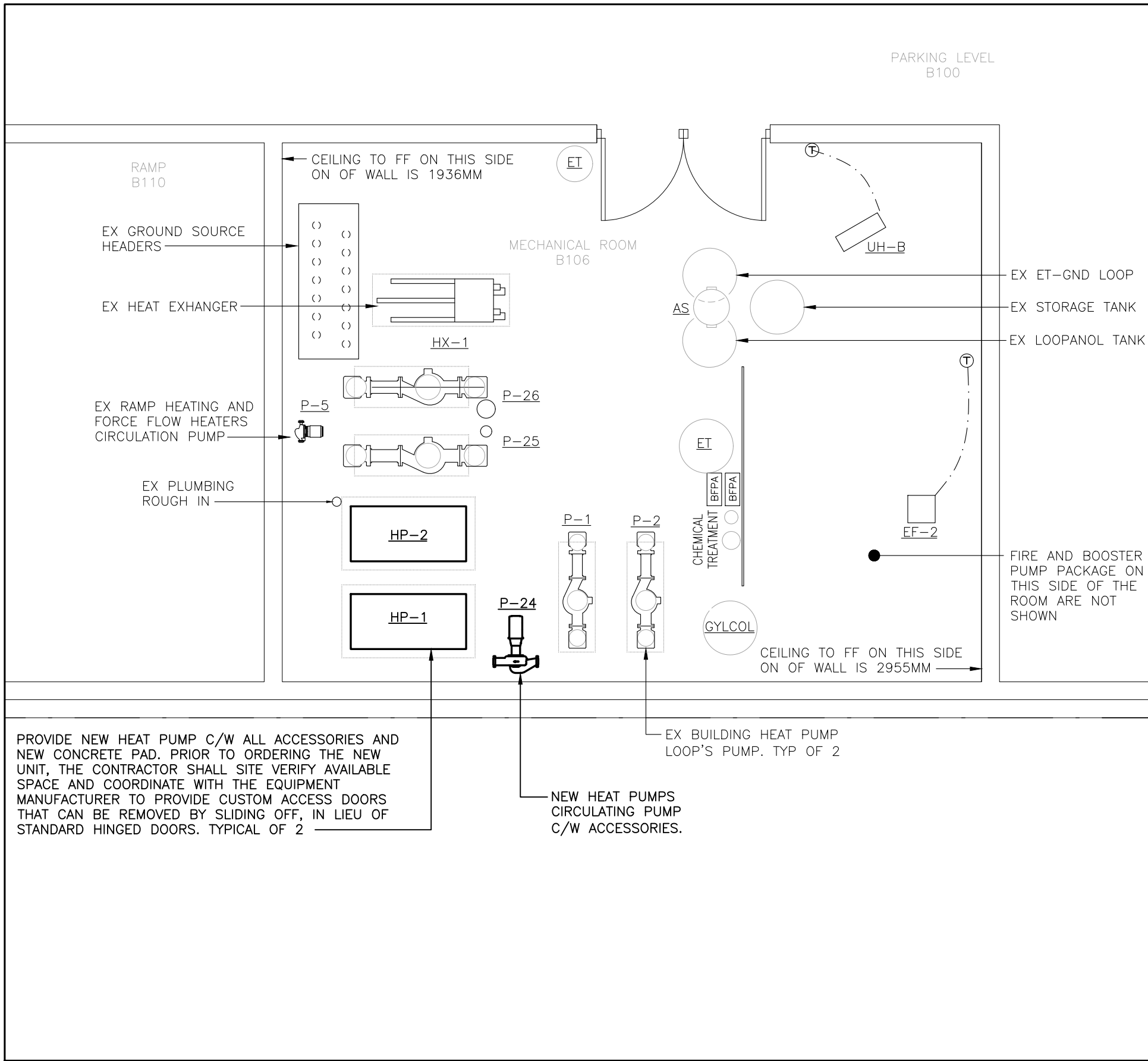
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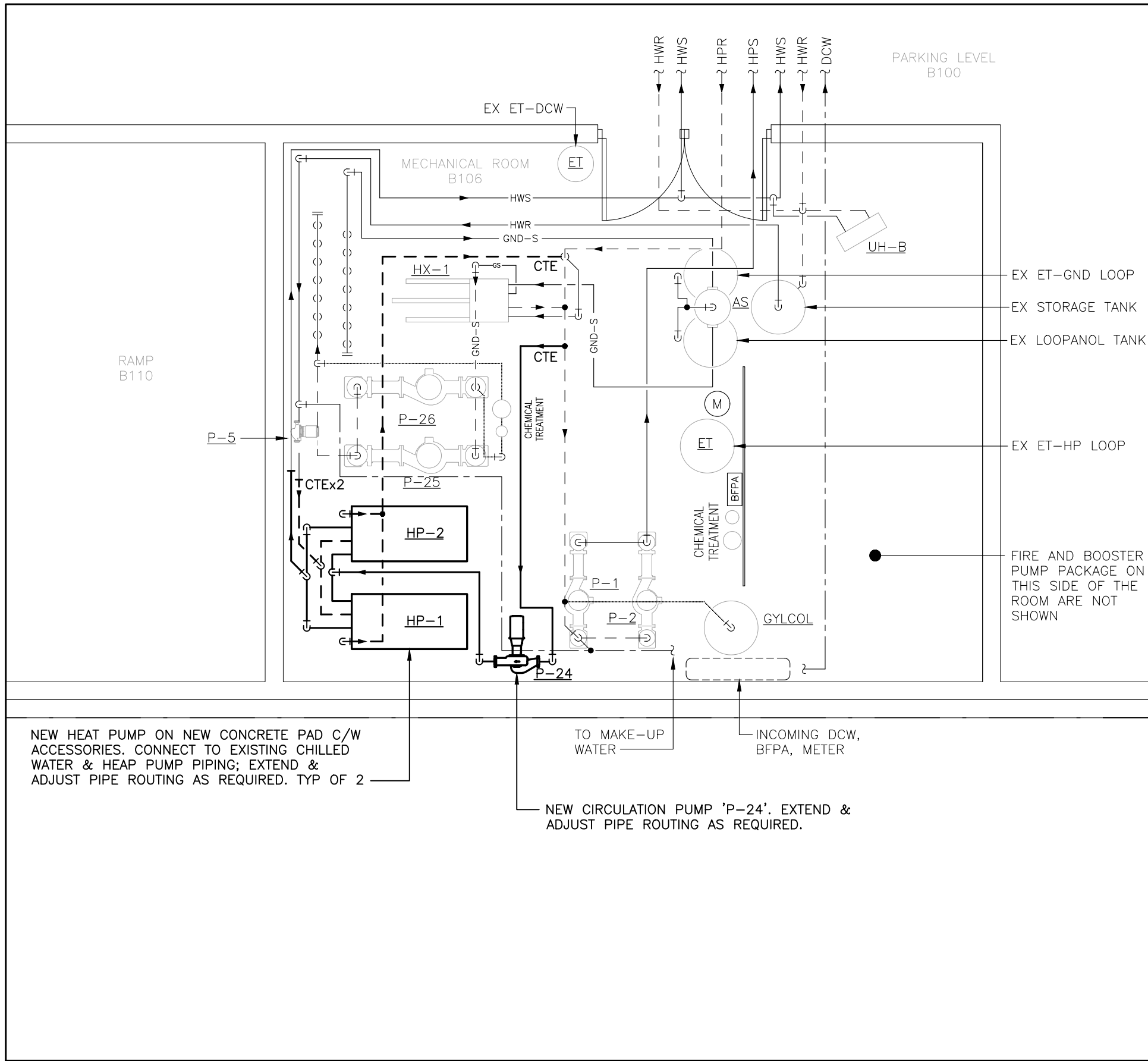
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M-4



MECHANICAL RM B106 LAYOUT -- NEW WORK
SCALE: 1:50



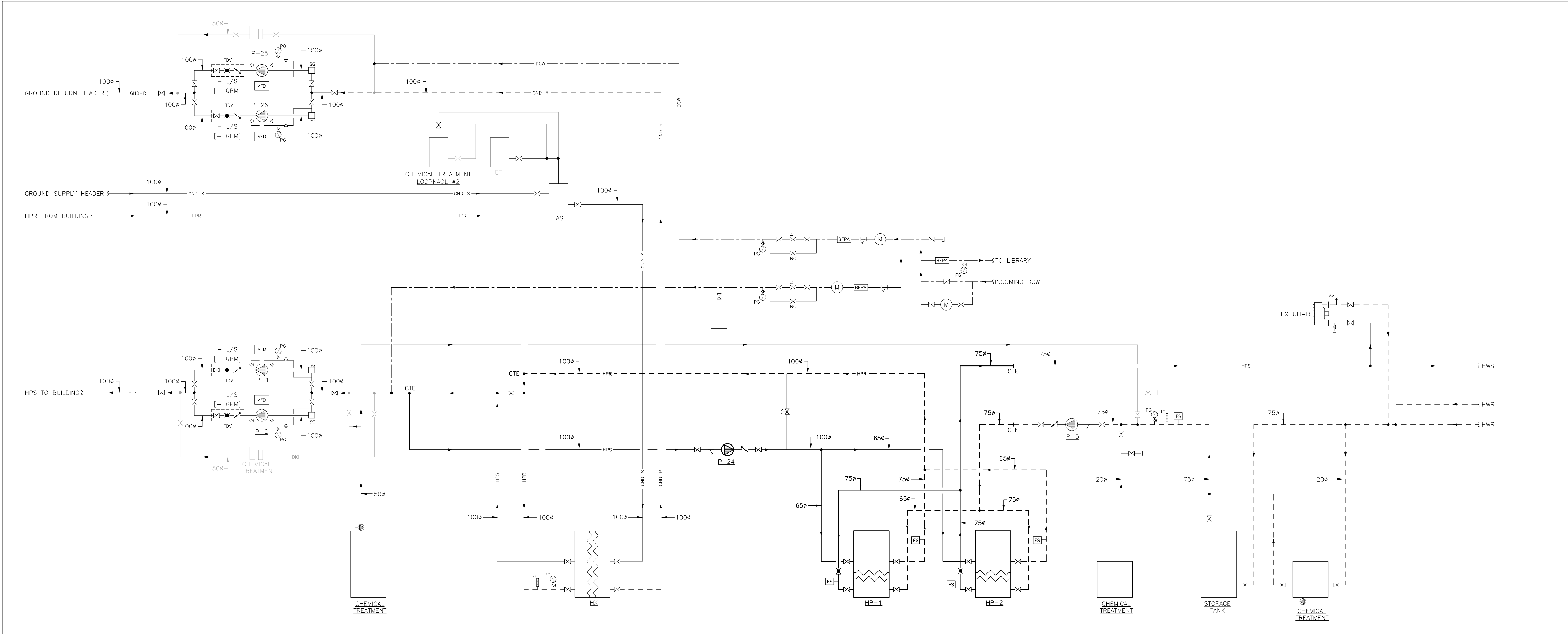
MECHANICAL RM B106 LAYOUT -- NEW WORK
SCALE: 1:50

GENERAL NOTES:

REFER TO M-4 FOR GENERAL NOTES.

BAS SEQUENCE OF OPERATION

1. THE NEW HP-1 AND HP-2 TO BE RECONNECTED BACK TO THE EXISTING BAS SYSTEM. CONNECT BACK TO THE BAS THE NEW PUMP P-24.
2. THE SEQUENCE OF OPERATION TO BE AS PER EXISTING STRATEGY IN ORDER TO MAINTAIN THE RAMP TEMPERATURE DURING WINTER BELOW THE FREEZING TEMPERATURE.
3. PROVIDE AND INSTALL ALL REQUIRED WIRING, SENSORS, RELAYS AND DEVICES TO CONNECT THE NEW EQUIPMENT; COORDINATE WITH THE EQUIPMENT MANUFACTURER CONTROLS FOR FULL INTEGRATION AND OPERATION.
4. UPGRADE THE EXISTING GRAPHICAL INTERPHACE AS REQUIRED.



MECHANICAL RM B106 -- PIPING SCHEMATIC DIAGRAM -- NEW WORK
SCALE: NTS

REVISION NO.

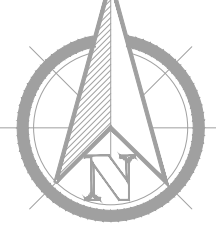
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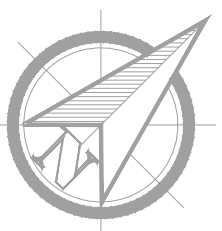
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PROJECT

HEAT PUMP UPGRADES
540 PLAINS ROAD E.
BURLINGTON, ONTARIO L7T 2E3

DRAWING TITLE

MECHANICAL ROOM B106
-- HVAC -- NEW WORKS

DATE

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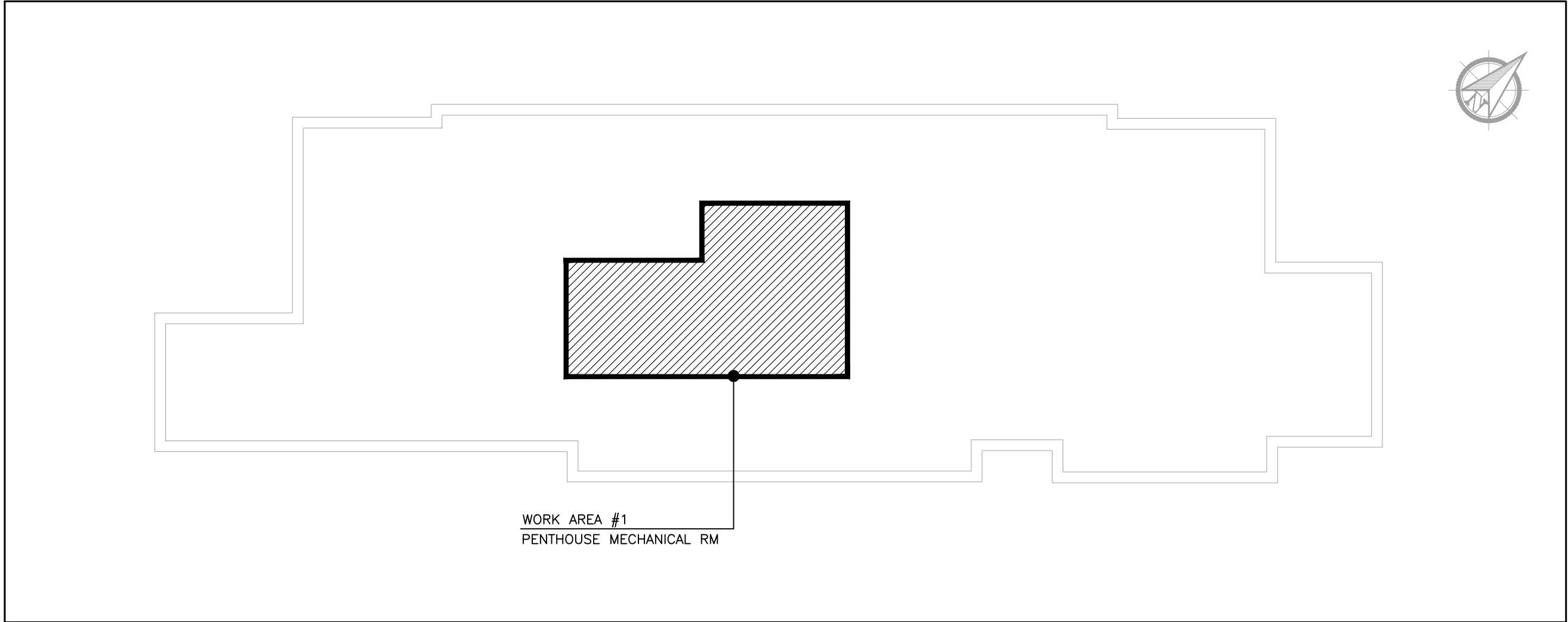
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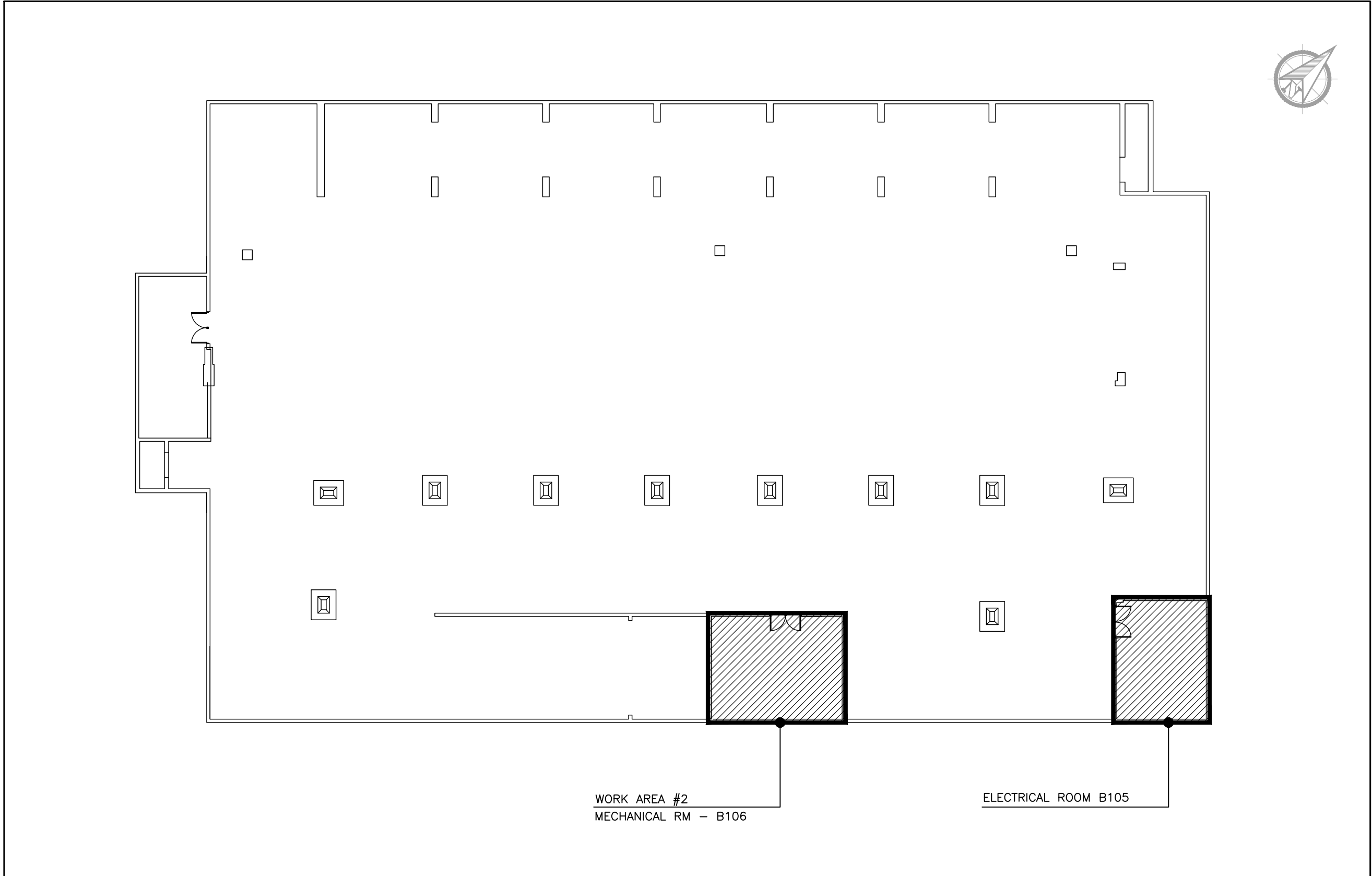
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DWG. No.

M-5



KEY PLAN -- ROOF
N.T.S.



KEY PLAN -- UNDERGROUND PARKING LEVEL
N.T.S.

MECHANICAL EQUIPMENT WIRING SCHEDULE							
EQUIPMENT DESCRIPTION	POWER SOURCE	STARTER TYPE	MCA/FLA/HP	V/ø/Hz	BREAKER SIZE OR FUSE SIZE	FEEDER SIZE	REMARKS
HP-1 HEAT PUMP	PANEL 'LP-C' (CONTRACTOR TO LOCATE & VERIFY LOCATION)	INTEGRAL	MCA = 32.6 A FLA = 29.0 A	575/3/60	45A-3P	3xAWG#8+G-27mmC	PROVIDE NEW FUSED DISCONNECT IN EXISTING ELECTRICAL PANEL 'LP-C'. PROVIDE A NEW LOCAL DISCONNECT. PROVIDE NEW WIRING IN CONDUIT FROM THE ELECTRICAL PANEL 'LP-G' TO THE HEAT PUMP UNIT'S LOCAL DISCONNECT. ALL WIRING TO BE IN METALLIC CONDUIT EXCEPT FOR LAST 900MM WHICH SHALL BE FLEXIBLE LIQUID TIGHT CONDUIT IN ACCORDANCE WITH SPECIFICATIONS.
HP-2 HEAT PUMP	PANEL 'LP-G' (CONTRACTOR TO LOCATE & VERIFY LOCATION)	INTEGRAL	MCA = 32.6 A FLA = 29.0 A	575/3/60	45A-3P	3xAWG#8+G-27mmC	PROVIDE NEW FUSED DISCONNECT IN EXISTING ELECTRICAL PANEL 'LP-G'. PROVIDE A NEW LOCAL DISCONNECT. PROVIDE NEW WIRING IN CONDUIT FROM THE ELECTRICAL PANEL 'LP-G' TO THE HEAT PUMP UNIT'S LOCAL DISCONNECT. ALL WIRING TO BE IN METALLIC CONDUIT EXCEPT FOR LAST 900MM WHICH SHALL BE FLEXIBLE LIQUID TIGHT CONDUIT IN ACCORDANCE WITH SPECIFICATIONS.
HP-3 HEAT PUMP	PANEL 'PP-3' PENTHOUSE MECHANICAL ROOM	INTEGRAL	MCA = 32.6 A FLA = 29.0 A	575/3/60	45A-3P	3xAWG#8+G-27mmC	PROVIDE NEW FUSED DISCONNECT IN EXISTING ELECTRICAL PANEL 'PP-3'. PROVIDE A NEW LOCAL DISCONNECT. PROVIDE NEW WIRING IN CONDUIT FROM THE ELECTRICAL PANEL 'PP-3' TO THE HEAT PUMP UNIT'S LOCAL DISCONNECT. ALL WIRING TO BE IN METALLIC CONDUIT EXCEPT FOR LAST 900MM WHICH SHALL BE FLEXIBLE LIQUID TIGHT CONDUIT IN ACCORDANCE WITH SPECIFICATIONS.
P-4 CIRCULATOR PUMP	PANEL 'LP-P' PENTHOUSE MECHANICAL ROOM	MAGNETIC	FLA = 3.1 A HP = 0.75	208/3/60	15A-3P	3xAWG#12+G-21mmC	PROVIDE NEW FUSED DISCONNECT IN EXISTING ELECTRICAL PANEL 'LP-P'. PROVIDE A NEW LOCAL MAGNETIC STARTER/DISCONNECT. PROVIDE NEW WIRING IN CONDUIT FROM THE ELECTRICAL PANEL 'LP-G' TO THE HEAT PUMP UNIT'S LOCAL DISCONNECT. ALL WIRING TO BE IN METALLIC CONDUIT EXCEPT FOR LAST 900MM WHICH SHALL BE FLEXIBLE LIQUID TIGHT CONDUIT IN ACCORDANCE WITH SPECIFICATIONS.
P-24 CIRCULATOR PUMP	MAIN SWITCHBOARD DP-61 ELECTRICAL ROOM B105	MAGNETIC	FLA = 2.7 A HP = 2.0	575/3/60	15A-3P	3xAWG#12+G-21mmC	RE-USE EXISTING FUSED DISCONNECT IN EXISTING MAIN SWITCHBOARD 'DP-61'. RE-USE EXISTING LOCAL MAGNETIC STARTER/DISCONNECT. PROVIDE NEW WIRING IN CONDUIT FROM THE EXISTING LOCAL MAGNETIC STARTER/DISCONNECT TO THE HEAT PUMP UNIT'S. ALL WIRING TO BE IN METALLIC CONDUIT EXCEPT FOR LAST 900MM WHICH SHALL BE FLEXIBLE LIQUID TIGHT CONDUIT IN ACCORDANCE WITH SPECIFICATIONS.
NOTES: PROVIDE CONNECTION TO MECHANICAL EQUIPMENT TO ENSURE THAT FULL OPERATIONAL SYSTEMS ARE DELIVERED TO THE BOARD. PROVIDE POWER CONNECTION TO ALL EQUIPMENT LISTED IN THE SCHEDULE. REFER TO ELECTRICAL AND MECHANICAL LAYOUTS FOR EXACT LOCATION OF EQUIPMENT. PROVIDE SEPARATE DISCONNECTS FOR INDIVIDUAL MECHANICAL EQUIPMENT. SIZE AS INDICATED IN THE SCHEDULE. DISCONNECTS LOCATIONS SHALL BE VERIFIED AND CO-ORDINATED ON SITE. ALL MAGNETIC STARTERS (WHERE REQUIRED) SHALL BE C/W OVERLOAD PROTECTION, H/O/A SWITCH AND GREEN-RUN AND RED-STOP PILOT LAMPS. PROVIDE POWER FOR CONTROLS AND STEPDOWN TRANSFORMER AS REQUIRED. PROVIDE ALL REQUIRED WIRING AND DEVICE FOR CONNECTION TO THE FIRE ALARM. INCLUDE FOR FIRE ALARM TESTING AS REQUIRED.							

ELECTRICAL GENERAL NOTES

GENERAL

EXAMINE ARCHITECTURAL, STRUCTURAL AND MECHANICAL CONDITIONS AND AVAILABLE DRAWINGS BEFORE PROCEEDING WITH THE WORK. ANY DISCREPANCIES BETWEEN DRAWINGS AND/OR SPECIFICATIONS MUST BE REFERRED TO THE PRIME CONSULTANT BEFORE ANY AFFECTED WORK IS COMMENCED.

ALL MATERIALS USED THROUGHOUT SHALL BE NEW, OF BEST QUALITY CSA APPROVED AND OF ONE MANUFACTURER.

OBTAIN AND PAY FOR APPROVALS AND PERMITS FROM AUTHORITIES HAVING JURISDICTION.

PROVIDE ALL CONDUIT, WIRING, BOXES, SWITCHES, OUTLETS, DEVICES, ETC, AS REQUIRED. MAKE UP TO THE LAST 3 FT OF FINAL CONNECTIONS TO ROTATING EQUIPMENT WITH LIQUID TIGHT FLEXIBLE CONDUIT.

CONTRACTORS SHALL NOTE THAT THIS CONTRACT IS AN ALTERATION TO AN EXISTING BUILDING AND SHALL THOROUGHLY INVESTIGATE THE EXISTING ELECTRICAL INSTALLATION AND CONDITIONS. DEMOLITION. REMOVE POWER CONNECTIONS AS SHOWN ON DRAWINGS C/W CONDUIT AND WIRING TO SOURCE.

CONDUCTORS AND CABLES

CONDUCTORS AND CABLES SHALL BE IN ACCORDANCE WITH NEMA WC-70 AND AS SPECIFIED HEREIN.

CONDUCTORS SHALL BE ANNEALED COPPER, STRANDED FOR SIZES NO. 8 AWG AND LARGER, SOLID FOR SIZES NO. 10 AWG AND SMALLER. CONDUCTORS SHALL BE MINIMUM SIZE NO. 12 AWG, EXCEPT WHERE SMALLER SIZES ARE SPECIFICALLY SHOWN ON THE DRAWINGS. MINIMUM SIZE WIRING FOR DC WIRING SHALL BE #10 GAUGE.

ALL WIRING SHALL BE 600 VOLT TYPE RW90 AND RUN IN METALLIC CONDUIT EXCEPT WHERE ALLOWED IN FLEXIBLE LIQUID-TIGHT FLEXIBLE ENCLOSURE (SEE SECTION 15241). MAXIMUM VOLTAGE DROP SHALL NOT EXCEED 2%. PROVIDE GROUND WIRES WITH ALL FEEDERS AND BRANCH CIRCUITS IN ACCORDANCE WITH APPLICABLE CODES AND ONTARIO ELECTRICAL SAFETY CODE REQUIREMENTS. PROVIDE MAIN GROUND TO ESA APPROVAL.

INSULATION:

THHN-THWN SHALL BE IN ACCORDANCE WITH NEMA WC-70, UL 44, AND UL 83.

CONDUITS

ALL CONDUIT SHALL BE RIGID ALUMINUM (OUTDOORS) OR EMT THINWALL (INDOORS) WITH STEEL SET SCREW COUPLINGS AND CONNECTORS WITH INSULATED THROATS UNLESS OTHERWISE NOTED. RUN CONDUITS PARALLEL TO BUILDING LINES AND CONCENTRIC RIGHT ANGLE BENDS ONLY SHALL BE USED.

SEAL ALL PENETRATIONS THROUGH FLOOR WALLS OR SLABS WITH AN APPROVED NON-SHRINK, WATERPROOF AND FIREPROOF SEALANT.

NEW CONDUIT HANGERS SHALL BE SUPPORTED FROM BUILDING STRUCTURE AND INDEPENDENTLY FROM OTHER EXISTING ELEMENTS SUCH AS DUCTWORK, CONDUITS, PIPING ETC.

POWER DISTRIBUTION SYSTEM

THE POWER DISTRIBUTION SYSTEM SHALL BE MODIFIED AS SHOWN ON THE PLANS AND AS HEREINAFTER SPECIFIED. BREAKERS RATING SHALL MATCH EXISTING EQUIPMENT TO WHICH THEY ARE INSTALLED.

SPLICES AND JOINTS

IN ACCORDANCE WITH UL 486A, C, D, E, AND NEC.

CONNECTORS: SOLDERLESS, SCREW ON, REUSABLE PRESSURE CABLE TYPE, RATED 600 V, 220° F [105° C], WITH INTEGRAL INSULATION, APPROVED FOR COPPER CONDUCTORS. THE INTEGRAL INSULATOR SHALL HAVE A SKIRT TO COMPLETELY COVER THE STRIPPED WIRES. THE NUMBER, SIZE, AND COMBINATION OF CONDUCTORS, AS LISTED ON THE MANUFACTURER'S PACKAGING, SHALL BE STRICTLY FOLLOWED.

CONNECTORS SHALL BE INDENT, HEX SCREW, OR BOLT CLAMP TYPE OF HIGH CONDUCTIVITY AND CORROSION RESISTANT MATERIAL, LISTED FOR USE WITH COPPER AND ALUMINUM CONDUCTORS. FIELD-INSTALLED COMPRESSION CONNECTORS FOR CABLE SIZES 250 MCM AND LARGER SHALL HAVE NOT FEWER THAN TWO CLAMPING ELEMENTS OR COMPRESSION INDENTS PER WIRE.

INSULATE SPLICES AND JOINTS WITH MATERIALS APPROVED FOR THE PARTICULAR USE, LOCATION, VOLTAGE, AND TEMPERATURE. SPICE AND JOINT INSULATION LEVEL SHALL BE NOT LESS THAN THE INSULATION LEVEL OF THE CONDUCTORS BEING JOINED. PLASTIC ELECTRICAL INSULATING TAPE: PER ASTM D2304, FLAME-RETARDANT, COLD AND WEATHER RESISTANT.

LOW VOLTAGE FUSED AND NON-FUSED DISCONNECT SWITCHES RATED 600 AMPERES AND LESS

IN ACCORDANCE WITH UL 98, NEMA KS1, AND NEC. SHALL HAVE NEMA CLASSIFICATION GENERAL DUTY (GD) FOR 240 V SWITCHES AND NEMA CLASSIFICATION HEAVY DUTY (HD) FOR 600 V SWITCHES. SHALL BE HP RATED.

LOCATE IN THE PROXIMITY OF THE EQUIPMENT SERVED, IN ACCORDANCE WITH NEC REQUIREMENTS.

SHALL HAVE THE FOLLOWING FEATURES:

- SWITCH MECHANISM SHALL BE THE QUICK-MAKE, QUICK-BREAK TYPE.
- COPPER BLADES, VISIBLE IN THE OFF POSITION.
- AN ARC CHUTE FOR EACH POLE.
- EXTERNAL OPERATING HANDLE SHALL INDICATE ON AND OFF POSITION AND HAVE LOCK OPEN PADLOCKING PROVISIONS.
- MECHANICAL INTERLOCK SHALL PERMIT OPENING OF THE DOOR ONLY WHEN THE SWITCH IS IN THE OFF POSITION, DEFEATABLE TO PERMIT INSPECTION.
- FUSE HOLDERS FOR THE SIZES AND TYPES OF FUSES SPECIFIED (WHERE APPLICABLE).
- WHERE APPLICABLE, FUSIBLE DISCONNECT SWITCHES SHALL BE FURNISHED COMPLETE WITH FUSES. ARRANGE FUSES SUCH THAT RATING INFORMATION IS READABLE WITHOUT REMOVING THE FUSE.
- SOLID NEUTRAL FOR EACH SWITCH BEING INSTALLED IN A CIRCUIT WHICH INCLUDES A NEUTRAL CONDUCTOR.
- GROUND LUGS FOR EACH GROUND CONDUCTOR.

ENCLOSURES:

SHALL BE THE NEMA TYPES SHOWN ON THE DRAWINGS FOR THE SWITCHES. WHERE THE TYPES OF SWITCH ENCLOSURES ARE NOT SHOWN, THEY SHALL BE THE NEMA TYPES MOST SUITABLE FOR THE AMBIENT ENVIRONMENTAL CONDITIONS, UNLESS OTHERWISE INDICATED ON THE PLANS. ALL OUTDOOR SWITCHES SHALL BE NEMA 3R. SHALL BE FINISHED WITH MANUFACTURER'S STANDARD GRAY BAKED ENAMEL PAINT OVER PRE-TREATED STEEL (FOR THE TYPE OF ENCLOSURE REQUIRED).

ELECTRICAL LEGEND

	DIRECT POWER OUTLET FOR USE AS NOTED INCLUDING FINAL CONNECTION.
	ELECTRICAL PANEL
	DISCONNECT SWITCH
	DISCONNECT SWITCH WITH OVER-CURRENT PROTECTION
	COMBINATON MAGNETIC MOTOR STARTER WITH DISCONNECT SWITCH
	COMBINATON MAGNETIC MOTOR STARTER WITH DISCONNECT SWITCH & OVERCURRENT PROTECTION
	VARIABLE FREQUENCY DRIVE
EX	DENOTES EXISTING TO REMAIN
R	DENOTES EXISTING TO BE REMOVED ENTIRELY U.N.O.
N	DENOTES NEW

GENERAL NOTES

1. CAREFULLY EXAMINE OTHER EXISTING UTILITY LINES SUCH AS GAS, WATER ETC. PRIOR TO START THE ELECTRICAL CONSTRUCTION WORKS AND COORDINATE WITH OTHER TRADES AND REPORT OF ANY DISCREPANCY PRIOR TO PROCEEDING.
2. REFER TO ELECTRICAL AND MECHANICAL LAYOUTS FOR EXACT LOCATION OF ALL EQUIPMENT.
3. LOCATIONS OF ALL NEW ELECTRICAL EQUIPMENT SHALL BE CONFIRMED WITH DIVISION 15 PRIOR TO INSTALLATION.

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PROJECT

HEAT PUMP UPGRADES
540 PLAINS ROAD E.
BURLINGTON, ONTARIO L7T 2E3

DRAWING TITLE

KEY PLAN, LEGENDS, GENERAL
NOTES, DETAIL & EQUIPMENT
WIRING SCHEDULES

DATE

DEC. 25

SCALE

N.T.S.

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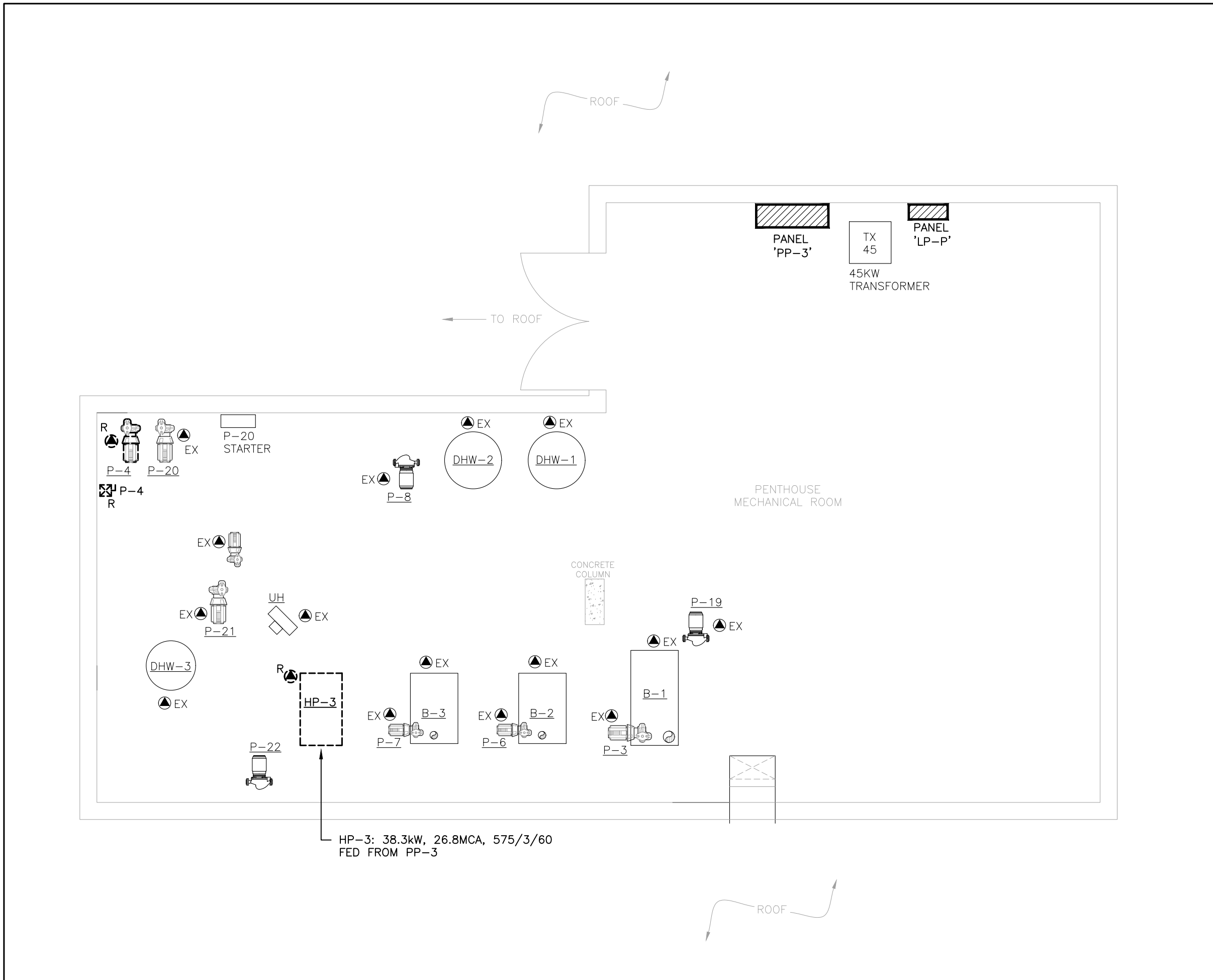
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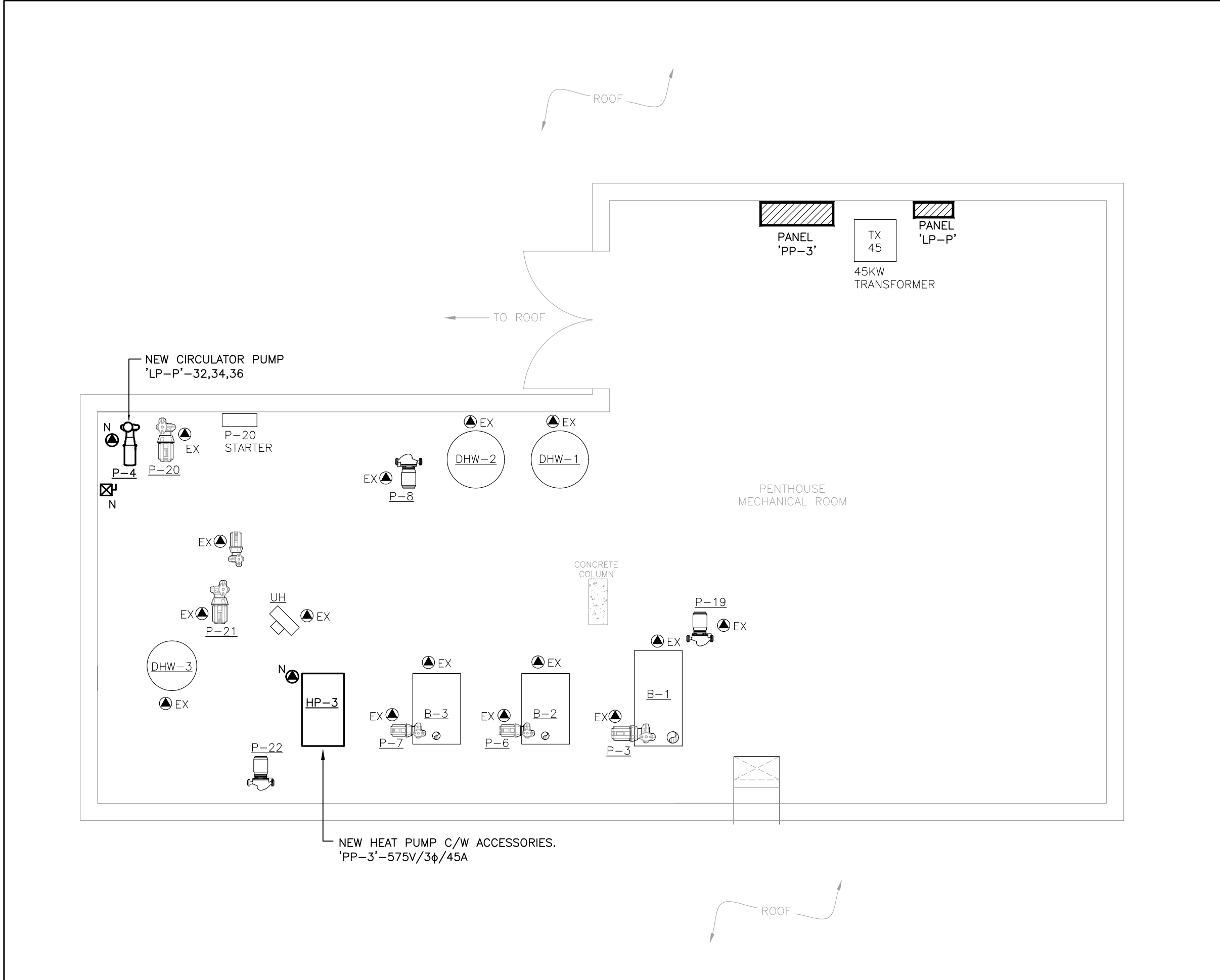
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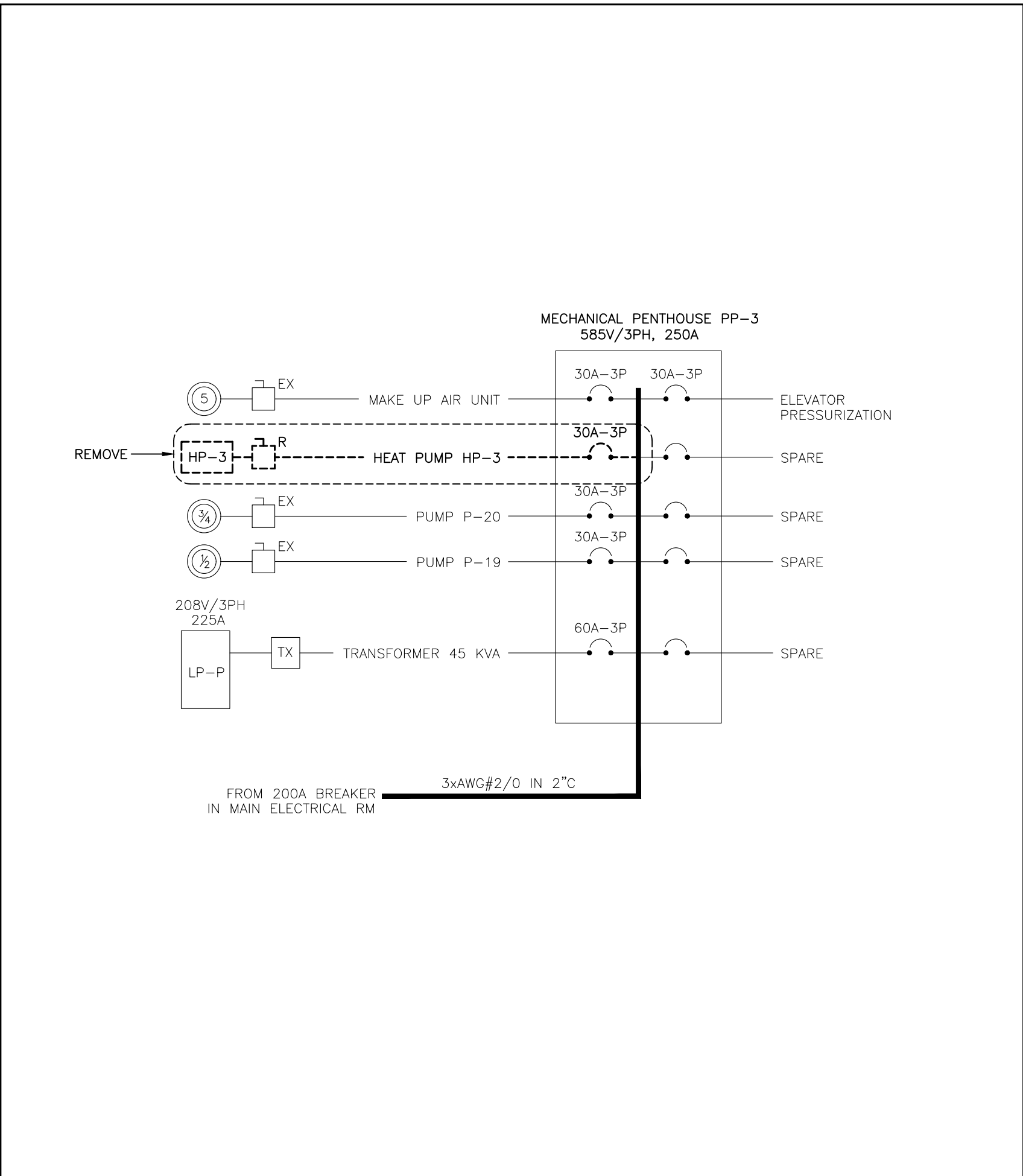
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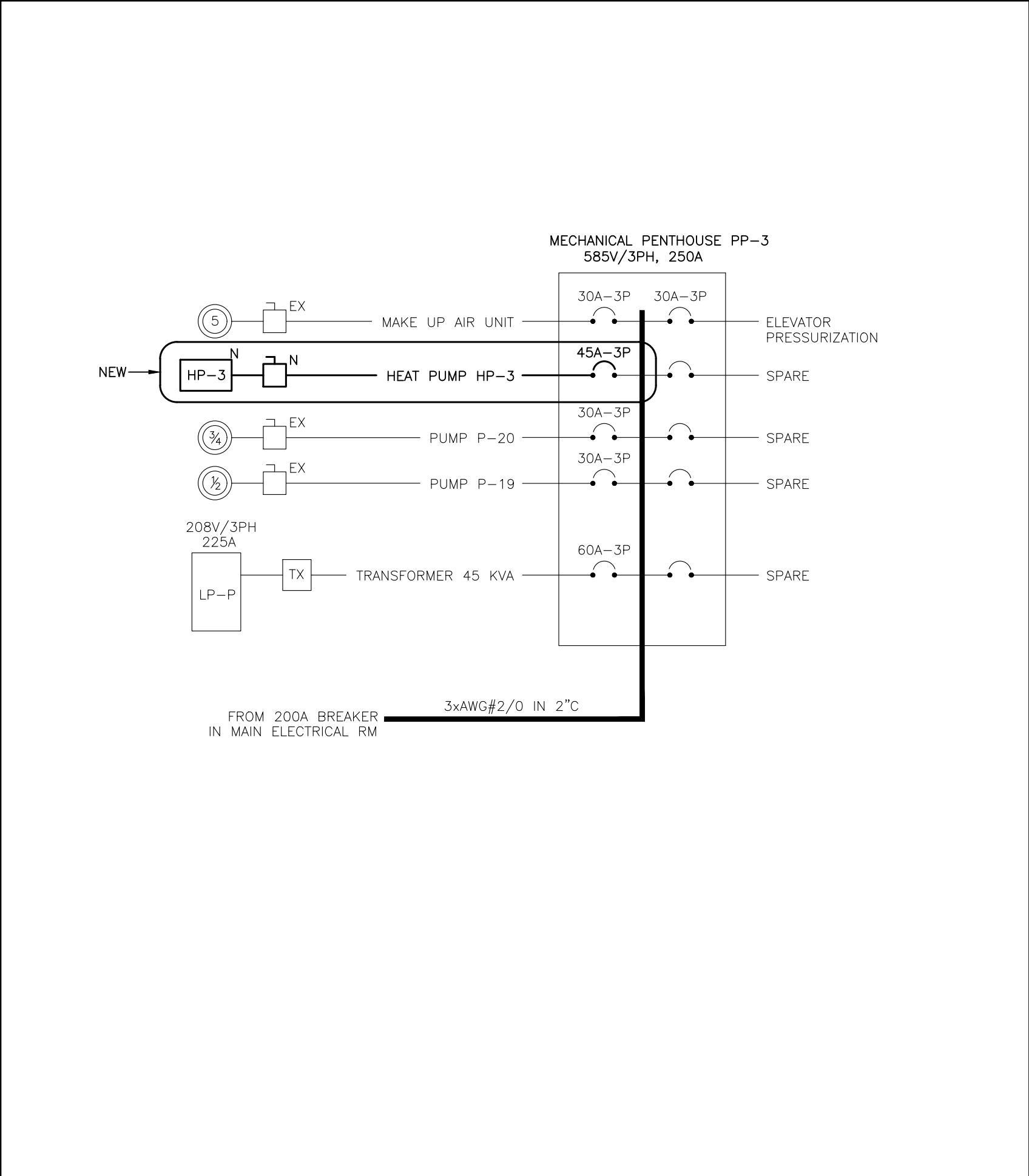
PENTHOUSE MECHANICAL RM — POWER PLAN — EXISTING & DEMOLITION WORK
SCALE: 1:50



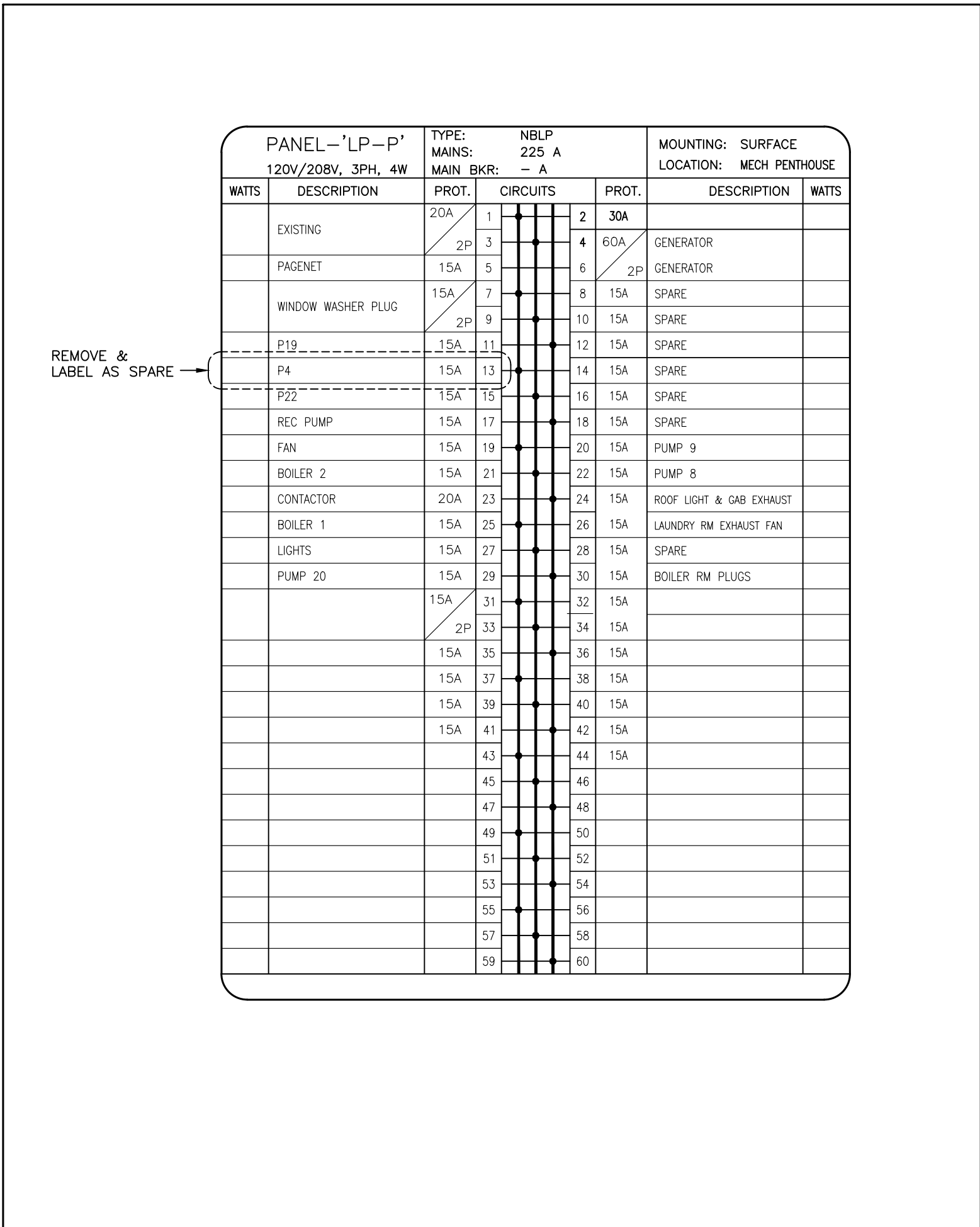
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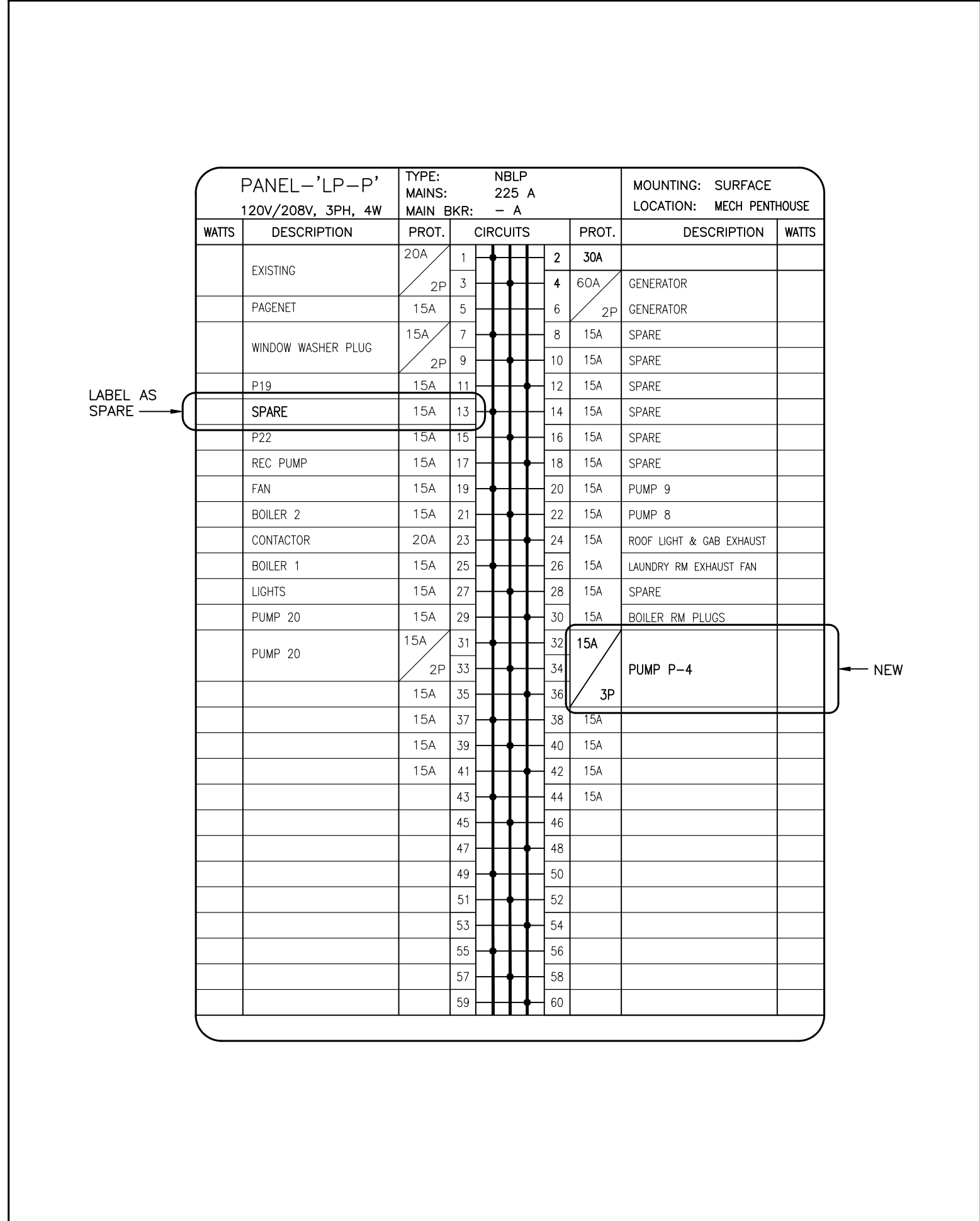
PANEL 'PP-3' — SLD — EXISTING & DEMOLITION WORK
SCALE: NTS



PANEL 'PP-3' — SLD — EXISTING & DEMOLITION WORK
SCALE: NTS



PANEL 'LP-P' — LAYOUT — EXISTING & DEMOLITION WORK
SCALE: NTS



PANEL 'LP-P' — LAYOUT — EXISTING & DEMOLITION WORK
SCALE: NTS

REVISION NO.

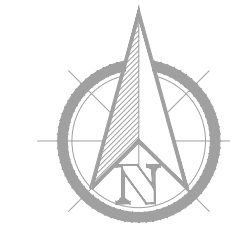
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1.	19/12/2025	ISSUED FOR 50% REVIEW
2.	19/03/2026	ISSUED FOR TENDER
3.	04/05/2026	ISSUED FOR TENDER

THE CONTRACTOR MUST VERIFY ALL DIMENSIONS ON AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
DO NOT SCALE DRAWINGS.

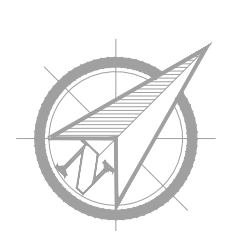
SEAL



NORTH



TRUE NORTH



CONSULTANT



588 EDWARD AVE., UNIT 25, RICHMOND HILL, ONT., L4C 9Y6
TEL. (905)-787 8885 FAX (905)-787 8771

PROJECT

HEAT PUMP UPGRADES
540 PLAINS ROAD E.
BURLINGTON, ONTARIO L7T 2E3

DRAWING TITLE

PENTHOUSE MECHANICAL ROOM
— POWER PLAN

DATE

DEC. 25

DRAWN BY

H.T.

JOB No.

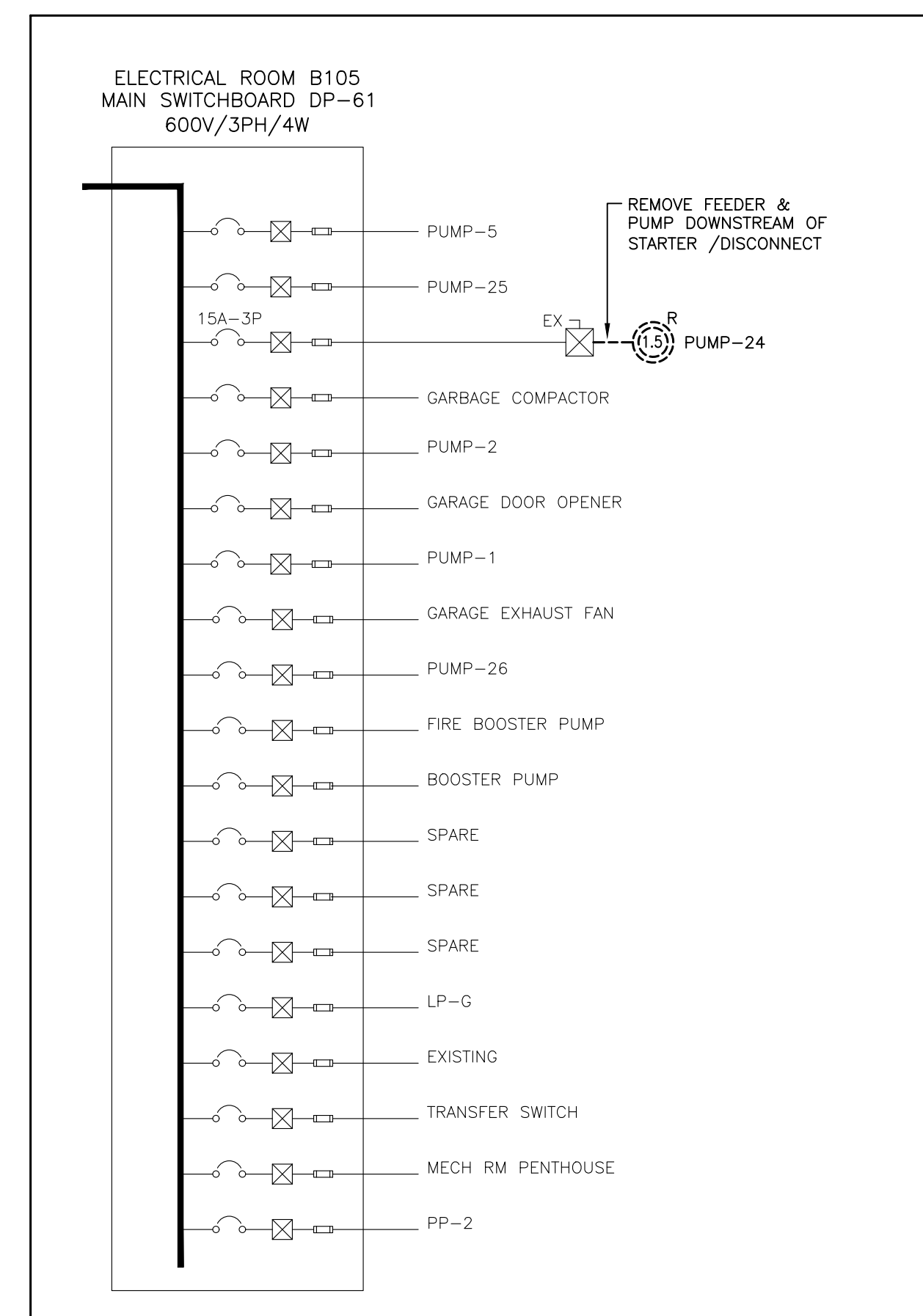
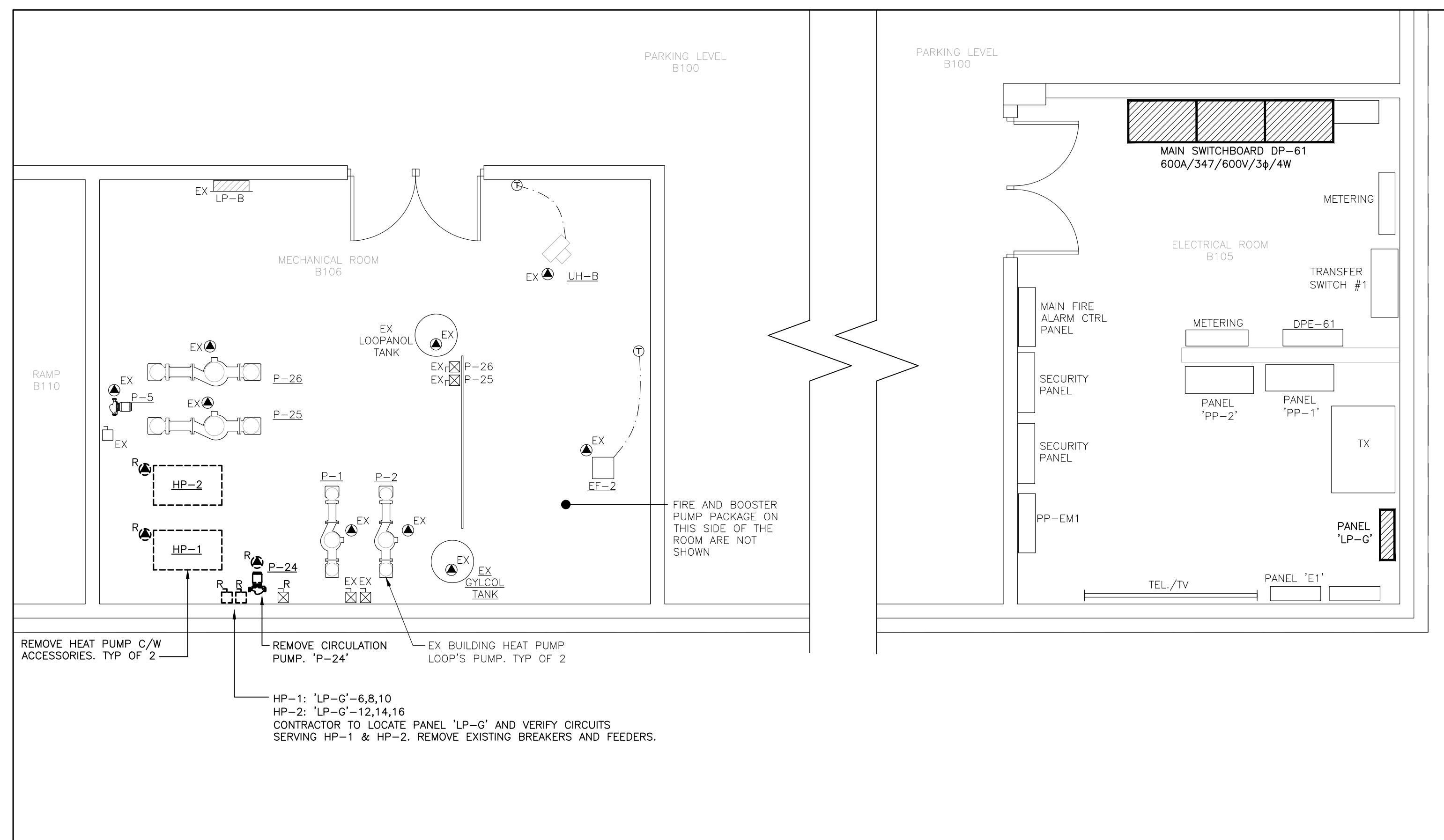
2024-27

SCALE

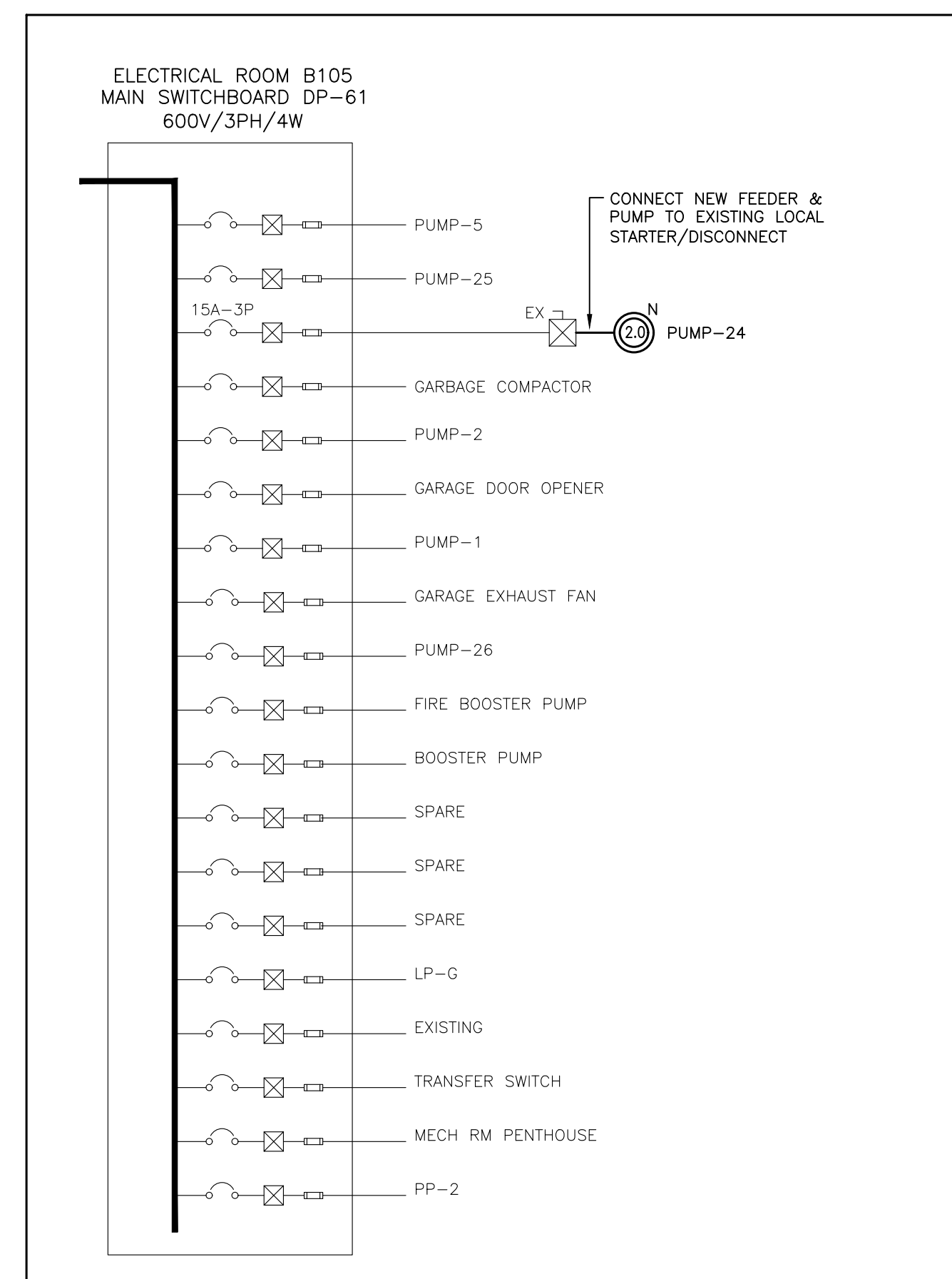
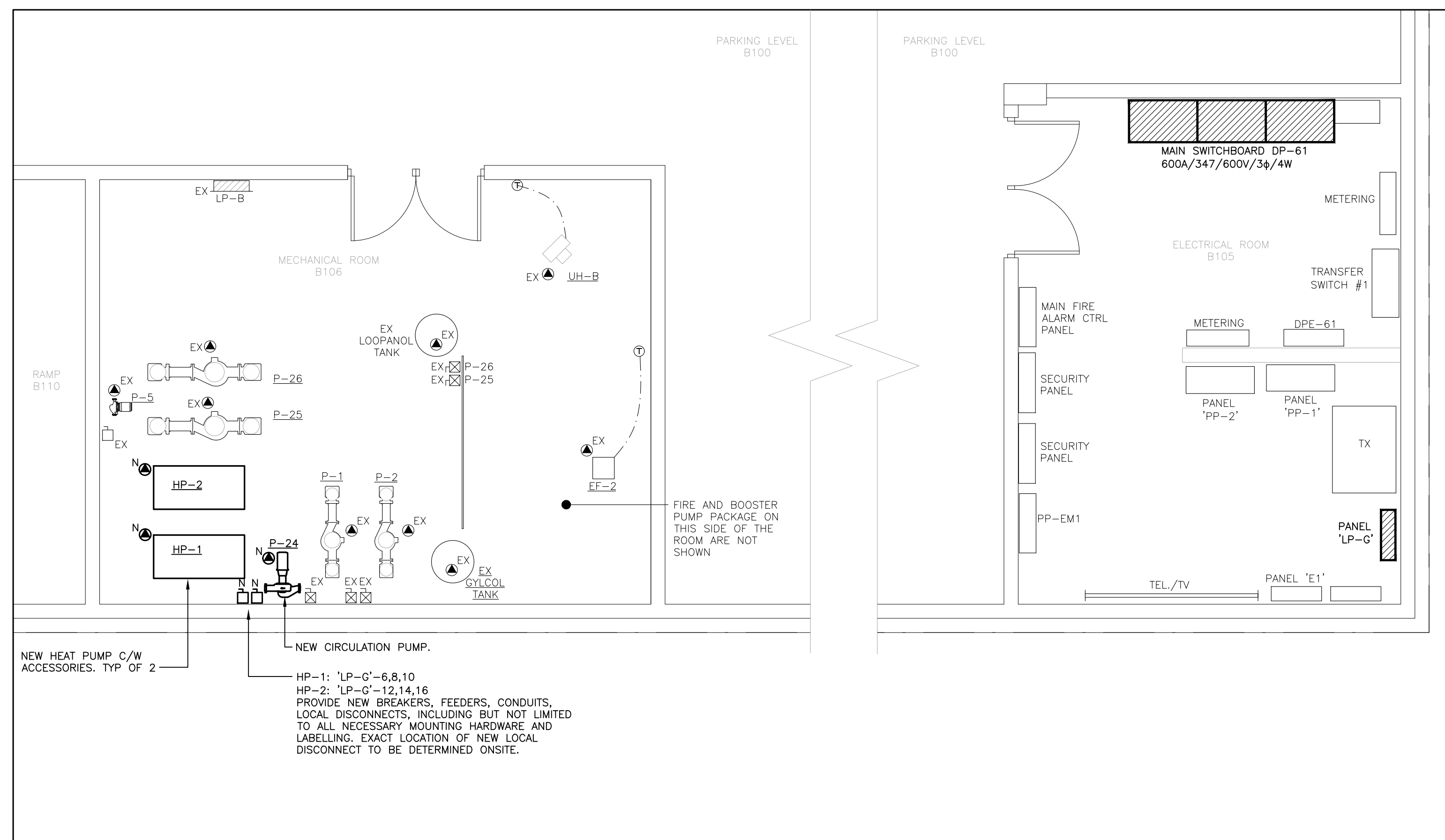
AS SHOWN

DWG. No.

E-2



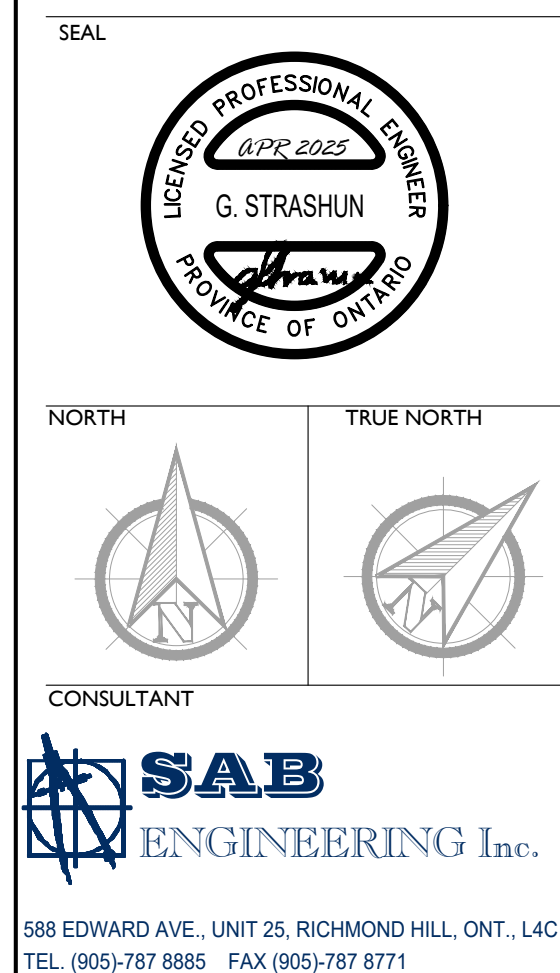
MAIN SWITCHBOARD - SLD - EXISTING & DEMOLITION WORK
SCALE: NTS



MAIN SWITCHBOARD - SLD - EXISTING & DEMOLITION WORK
SCALE: NTS

[illegible]

THE CONTRACTOR MUST VERIFY ALL DIMENSIONS
ON AND REPORT ANY DISCREPANCIES TO THE
ENGINEER BEFORE PROCEEDING WITH THE WORK.
DO NOT SCALE DRAWINGS.



ATTACHMENT C

ASBESTOS ASSESSMENT

August 15, 2023



Asbestos Assessment

Aldershot Village Seniors
Residence

540 Plains Road East, Burlington,
Ontario L7T 2E4

Prepared for:

Halton Region

1151 Bronte Road
Oakville, Ontario, L6M 3L1

August 15, 2023

Pinchin File: 320580.001

**Asbestos Assessment**

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001

Issued to: Halton Region
Issued on: August 15, 2023
Pinchin File: 320580.001
Issuing Office: Hamilton, ON

A handwritten signature in black ink, appearing to read "Justin Appleby".

Author:

Justin Appleby, ADip.T. (Arch)
Project Technologist
289.925.3875
jappleby@pinchin.com

A handwritten signature in black ink, appearing to read "Leslie Heywood".

Reviewer:

Leslie Heywood, BEng Mgt
Senior Project Manager
289.237.4294
lheywood@pinchin.com

**Asbestos Assessment**

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001

EXECUTIVE SUMMARY

Halton Region (Client) retained Pinchin Ltd. (Pinchin) to conduct an asbestos building materials assessment of Aldershot Village Seniors Residence located at 540 Plains Road East, Burlington, Ontario L7T 2E4. The assessment was performed on May 31, 2023.

The objectives of the assessment were to document the locations of asbestos-containing building materials, evaluate their condition and develop corrective action plans as required for the purposes of long-term management. The results of this assessment are not intended for construction, renovation, demolition, or project tendering purposes.

SUMMARY OF FINDINGS

Asbestos-containing materials (ACM) were not found during this assessment.

SUMMARY OF RECOMMENDATIONS

The following is a summary of significant recommendations; refer to the body of the report for detailed recommendations:

1. Perform a pre-construction assessment and remove all ACM prior to alteration or maintenance work if ACM may be disturbed by the work.
2. Sample any presumed ACM if it may be disturbed by any planned work.

This Executive Summary is subject to the same standard limitations as contained in the report and must be read in conjunction with the entire report.

**Asbestos Assessment**

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001

TABLE OF CONTENTS

1.0	INTRODUCTION AND SCOPE	2
1.1	Scope of Assessment.....	2
2.0	METHODOLOGY	2
3.0	BACKGROUND INFORMATION	2
3.1	Building Description	2
4.0	FINDINGS	3
4.1	Spray-Applied Insulation.....	3
4.2	Texture Finishes (Decorative)	3
4.3	Pipe Insulation	4
4.4	Duct Insulation	4
4.5	Mechanical Equipment Insulation.....	4
4.6	Acoustic Ceiling Tiles	4
4.7	Drywall Joint Compound.....	5
4.8	Other Building Materials	6
4.9	Excluded Asbestos Materials	6
5.0	RECOMMENDATIONS.....	7
5.1	General	7
5.2	Remedial Work	7
5.3	On-going Management and Maintenance	7
6.0	TERMS AND LIMITATIONS	7
7.0	REFERENCES.....	8

APPENDICES

APPENDIX I	Drawings
APPENDIX II	Asbestos Analytical Certificates
APPENDIX III	Methodology
APPENDIX IV	Location Summary Report
APPENDIX V	Asbestos Material Summary Report / Sample Log
APPENDIX VI	HMIS Data Report

**Asbestos Assessment**

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001

1.0 INTRODUCTION AND SCOPE

Halton Region (Client) retained Pinchin Ltd. (Pinchin) to conduct an asbestos building materials assessment of Aldershot Village Seniors Residence located at 540 Plains Road East, Burlington, Ontario L7T 2E4.

Pinchin performed the assessment on May 31, 2023. The surveyor was accompanied by a representative of the Client during the assessment. The assessed area was occupied at the time of the assessment.

The objectives of the assessment were to document the locations of asbestos-containing building materials, evaluate their condition and develop corrective action plans as required. This assessment is only to be used for the purposes of long-term management and routine maintenance. The results of this assessment are not to be used for construction, renovation, demolition, or project tendering purposes.

1.1 Scope of Assessment

The assessment was performed to establish the location and type of asbestos building materials incorporated in the structure(s) and its finishes. The **assessed area** consisted of all common areas of the building (e.g., corridors, mechanical rooms, storage areas, etc.), excluding the building exterior (e.g., exterior cladding and roof) and a representative selection of the tenant units (approximately 10%).

2.0 METHODOLOGY

Pinchin conducted a room-by-room assessment (rooms, corridors, service areas, etc.) to identify the asbestos-containing building materials as defined in the scope.

The assessment was limited to non-intrusive testing. Concealed spaces such as those above solid ceilings and within shafts and pipe chases were accessed via existing access panels only. Demolition of walls, solid ceilings, structural items, interior finishes, or exterior building finishes, to determine the presence of concealed materials was not conducted.

Demolition of masonry block walls (core holes) was not conducted to investigate for loose fill vermiculite insulation. Sampling of roofing materials was not conducted.

For further details on the methodology including test methods, refer to Appendix III.

3.0 BACKGROUND INFORMATION

3.1 Building Description

Description Item	Details
Use	Apartment
Number of Floors	The building is 6 storeys.

**Asbestos Assessment**

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001

Description Item	Details
Total Area	The total area of the building is 51,121 square feet.
Year of Construction	The building was constructed in 2011.

4.0 FINDINGS

The following section summarizes the findings of the assessment and provides a general description of the asbestos-containing materials (ACM) identified and their locations. For details on approximate quantities, condition, friability, accessibility, and locations of asbestos materials; refer to the Asbestos Material Summary Report and All Data Report in Appendices V and VI.

4.1 Spray-Applied Insulation

Non-asbestos spray-applied fireproofing and overspray is present on the structure throughout the assessed area (samples S0003A-G, photo 1).



Photo 1

4.2 Texture Finishes (Decorative)

The following table presents a summary of texture finish samples:

Sample Locations	Sample Number	Asbestos Type
Amenity Room (Location 9)	S0004A-C	None detected
Unit 302 (Location 15)	S0006A-C	None detected
Unit 307 (Location 16)	S0008A-C	None detected
Unit 405 (Location 20)	S0010A-C	None detected
Unit 501 (Location 22)	S0012A-C	None detected
Unit 607 (Location 24)	S0014A-C	None detected
Unit 502 (Location 10)	S0016A-C	None detected
Unit 209 (Location 11)	S0018A-C	None detected

**Asbestos Assessment**

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001



Photo 1



Photo 2

4.3 Pipe Insulation

Pipes are insulated with fibreglass, or other non-asbestos insulation such as mineral fibre or elastomeric foam insulation (photo 1).



Photo 1

4.4 Duct Insulation

Ducts are either uninsulated or insulated with non-asbestos fibreglass (foil-faced or canvas).

4.5 Mechanical Equipment Insulation

Mechanical equipment is either uninsulated or insulated with non-asbestos fibreglass.

4.6 Acoustic Ceiling Tiles

Acoustic ceiling tiles are present in the assessed area, as follows:

**Asbestos Assessment**

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001

Size, Type, Pattern, and Photo #	Sample Locations	Sample Number, Date Code, or Material Composition	Asbestos Type
24"x24", lay-in, pinhole with fleck, photo 1	Not sampled	2011	No
24"x24", lay-in, textured, photo 2	Not sampled	06/17/19 (Drywall)	No

All ceiling tiles are presumed to be non-asbestos based on the composition of the tiles (e.g., fiberglass, wood fibre, gypsum) or the date stamp.

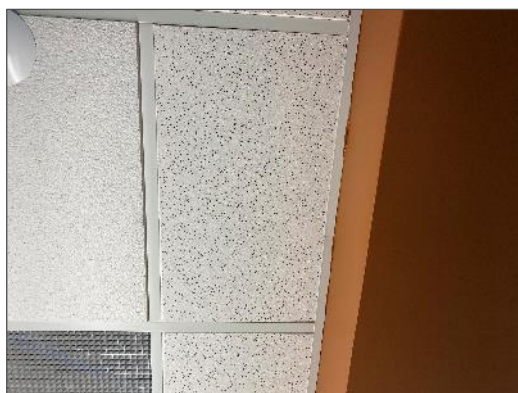


Photo 1



Photo 2

4.7 Drywall Joint Compound

The following table presents a summary of drywall joint compound samples:

Sample Locations	Sample Number	Asbestos Type
Vestibule (Location 1) Lobby (Location 4) Garage (Location 5) Apartment Manager's Office (Location 7) 5 th Floor Corridor (Location 21) 6 th Floor Corridor (Location 23)	S0001A-G	None detected
Unit 302 (Location 15)	S0005A-C	None detected
Unit 307 (Location 16)	S0007A-C	None detected
Unit 405 (Location 20)	S0009A-C	None detected
Unit 501 (Location 22)	S0011A-C	None detected
Unit 607 (Location 24)	S0013A-C	None detected
Unit 502 (Location 10)	S0015A-C	None detected
Unit 209 (Location 11)	S0017A-C	None detected

**Asbestos Assessment**

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001



Photo 1

4.8 Other Building Materials

The following is a summary of other materials sampled, for a complete list of locations, refer to Appendix V.

Description	Sample Location (Location #)	Sample Number	Asbestos
Paint on concrete block, photo 1	Stairwells (Location 3) Garbage (Location 5)	S0002A-E	None detected

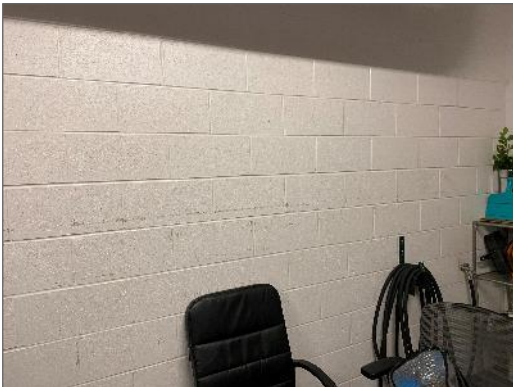


Photo 1

4.9 Excluded Asbestos Materials

The following is a list of materials which may contain asbestos and was excluded from the assessment. These materials are presumed to contain asbestos until otherwise proven by sampling and analysis:

- Roofing tar, mastics
- Ceramic tile setting compound
- Elevator and lift brakes



Asbestos Assessment

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001

- Electrical components
- Mechanical packing, ropes, and gaskets
- Vermiculite
- Adhesives and duct mastics
- Caulking and putties
- Paper products
- Fire resistant doors
- Vibration dampers on HVAC equipment
- Sealants on pipe threads

5.0 RECOMMENDATIONS

5.1 General

Perform a detailed intrusive assessment prior to building renovation or demolition operations. The assessment should include destructive testing (e.g., coring and/or removal of building finishes and components), and other hazardous materials (lead, mercury, PCBs, mould, etc.) and materials not tested in this study (e.g., roofing materials, caulking, mastics).

5.2 Remedial Work

No remedial work is recommended.

5.3 On-going Management and Maintenance

The following recommendations are made regarding on-going management and maintenance work involving the asbestos materials identified.

5.3.1 Asbestos

Sample any presumed asbestos-containing materials (ACM) prior to alteration or maintenance work if presumed ACM may be disturbed by the work.

6.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third

**Asbestos Assessment**

Aldershot Village Seniors Residence, 540 Plains Road East, Burlington, Ontario L7T 2E4
Halton Region

August 15, 2023

Pinchin File: 320580.001

party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

7.0 REFERENCES

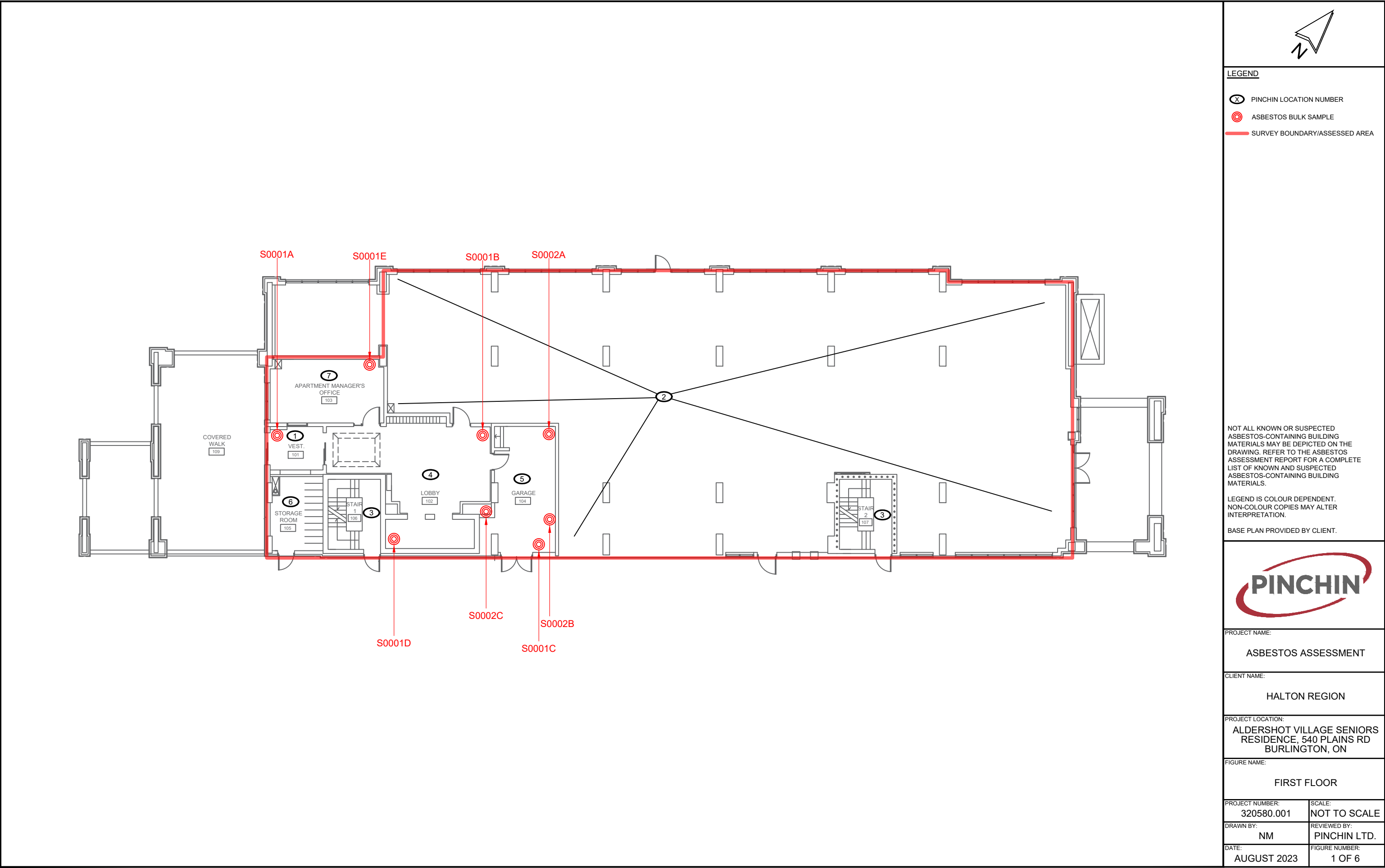
The following legislation and documents were referenced in completing the assessment and this report:

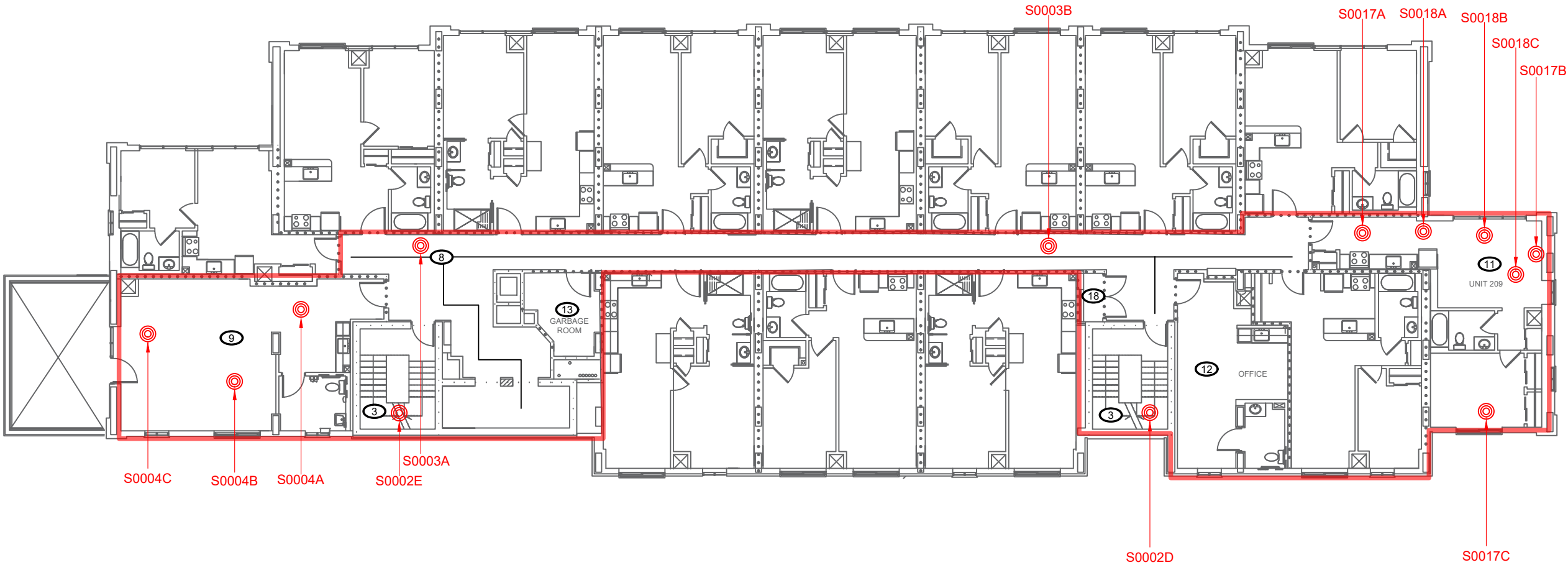
1. Asbestos on Construction Projects and in Buildings and Repair Operations, Ontario Regulation 278/05.
2. Designated Substances, Ontario Regulation 490/09.
3. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 347 as amended.

\\pinchin.com\ham\Job\320000s\0320580.000 HALTON,Various2023Projects,HAZ,CONS\0320580.001
HALTON,VariousSites&Facilities,HAZ,ASSMT\Deliverables\24_Aldershot Village SR\Deliverables\320580.001 ACM Report 540 Plains Road East, Burlington HALTON Aug 15
2023.docx

Template: Master Report for Asbestos Assessment, HAZ, July 29, 2021

APPENDIX I
Drawings





LEGEND

- PINCHIN LOCATION NUMBER
- ASBESTOS BULK SAMPLE
- SURVEY BOUNDARY/ASSESSED AREA

NOT ALL KNOWN OR SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE ASBESTOS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

BASE PLAN PROVIDED BY CLIENT.



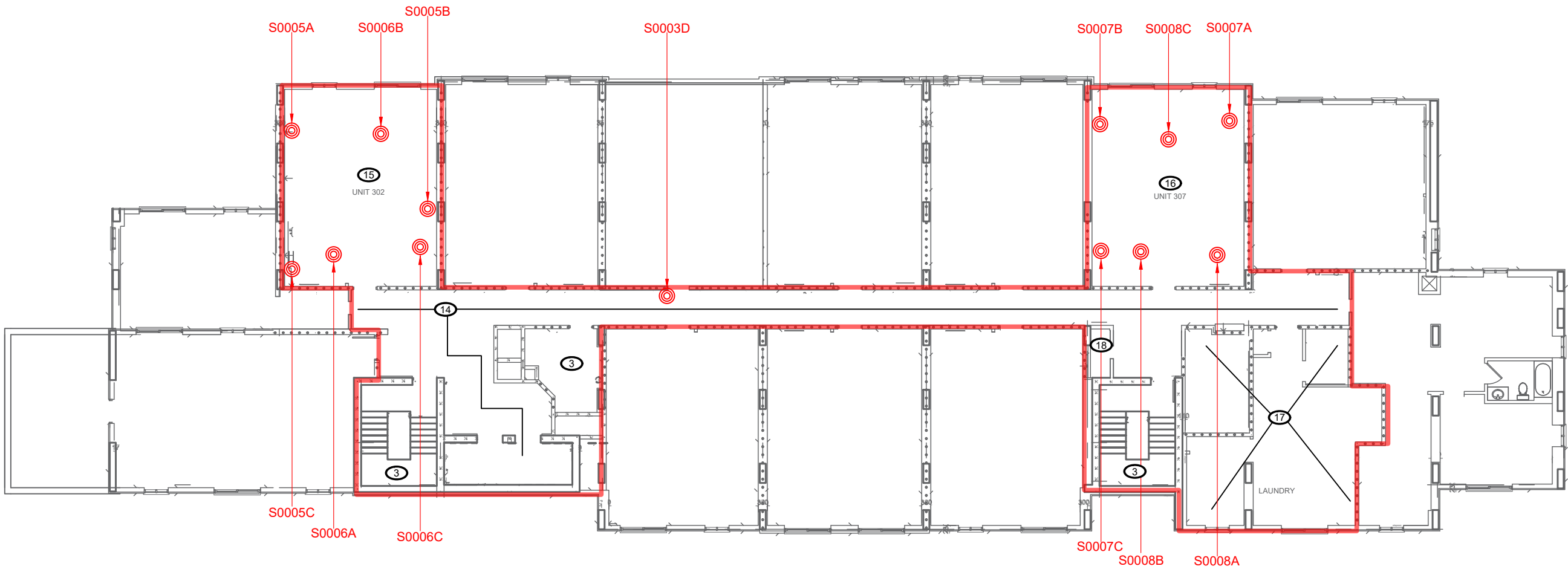
PROJECT NAME:
ASBESTOS ASSESSMENT

CLIENT NAME:
HALTON REGION

PROJECT LOCATION:
ALDERSHOT VILLAGE SENIORS
RESIDENCE, 540 PLAINS RD
BURLINGTON, ON

FIGURE NAME:
SECOND FLOOR

PROJECT NUMBER: 320580.001	SCALE: NOT TO SCALE
DRAWN BY: NM	REVIEWED BY: PINCHIN LTD.
DATE: AUGUST 2023	FIGURE NUMBER: 2 OF 6



LEGEND

- PINCHIN LOCATION NUMBER
- ASBESTOS BULK SAMPLE
- SURVEY BOUNDARY/ASSESSED AREA

NOT ALL KNOWN OR SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE ASBESTOS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

BASE PLAN PROVIDED BY CLIENT.



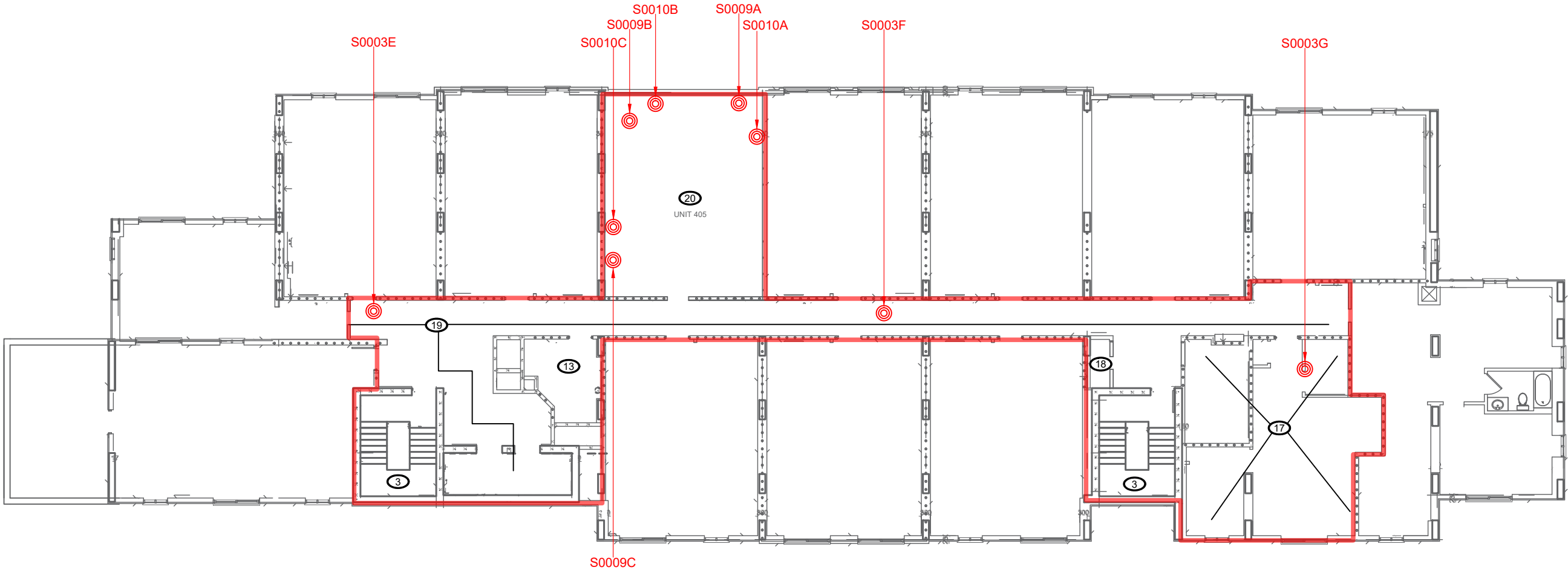
PROJECT NAME:
ASBESTOS ASSESSMENT

CLIENT NAME:
HALTON REGION

PROJECT LOCATION:
ALDERSHOT VILLAGE SENIORS
RESIDENCE, 540 PLAINS RD
BURLINGTON, ON

FIGURE NAME:
THIRD FLOOR

PROJECT NUMBER: 320580.001	SCALE: NOT TO SCALE
DRAWN BY: NM	REVIEWED BY: PINCHIN LTD.
DATE: AUGUST 2023	FIGURE NUMBER: 3 OF 6



LEGEND

- PINCHIN LOCATION NUMBER
- ASBESTOS BULK SAMPLE
- SURVEY BOUNDARY/ASSESSED AREA

NOT ALL KNOWN OR SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE ASBESTOS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

BASE PLAN PROVIDED BY CLIENT.



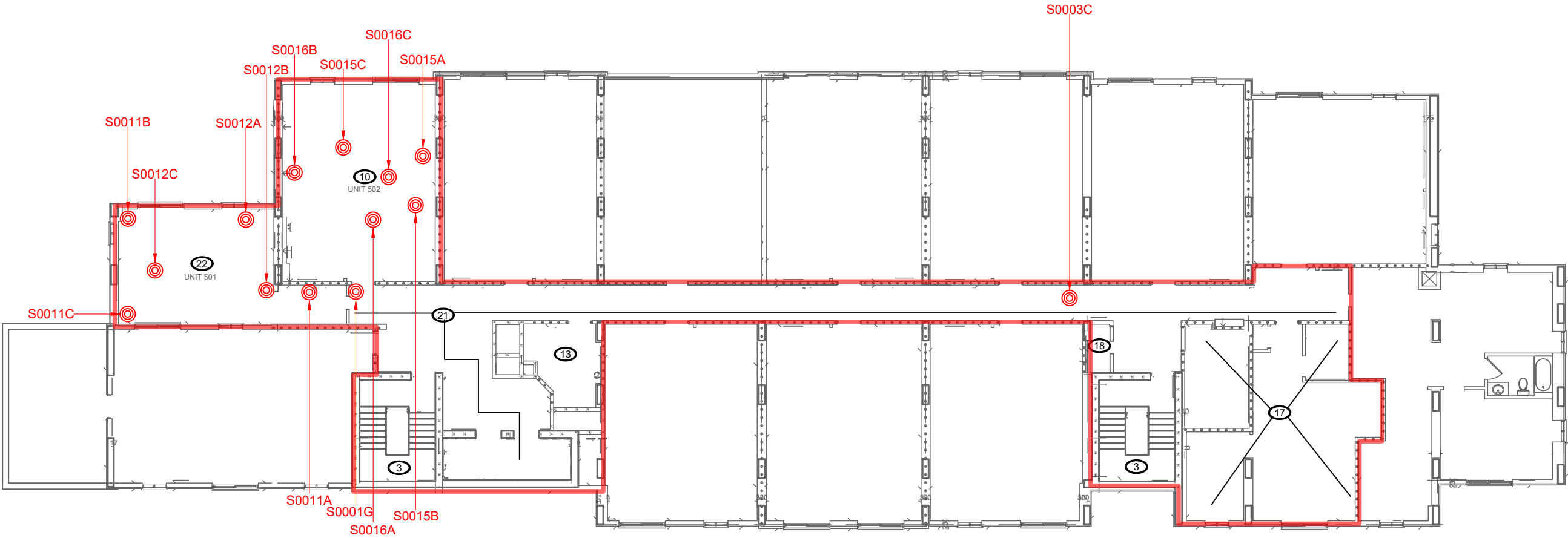
PROJECT NAME:
ASBESTOS ASSESSMENT

CLIENT NAME:
HALTON REGION

PROJECT LOCATION:
ALDRSHOT VILLAGE SENIORS
RESIDENCE, 540 PLAINS RD
BURLINGTON, ON

FIGURE NAME:
FOURTH FLOOR

PROJECT NUMBER: 320580.001	SCALE: NOT TO SCALE
DRAWN BY: NM	REVIEWED BY: PINCHIN LTD.
DATE: AUGUST 2023	FIGURE NUMBER: 4 OF 6



LEGEND

-  PINCHIN LOCATION NUMBER
-  ASBESTOS BULK SAMPLE
-  SURVEY BOUNDARY/ASSESSED AREA

NOT ALL KNOWN OR SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE ASBESTOS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

BASE PLAN PROVIDED BY CLIENT.



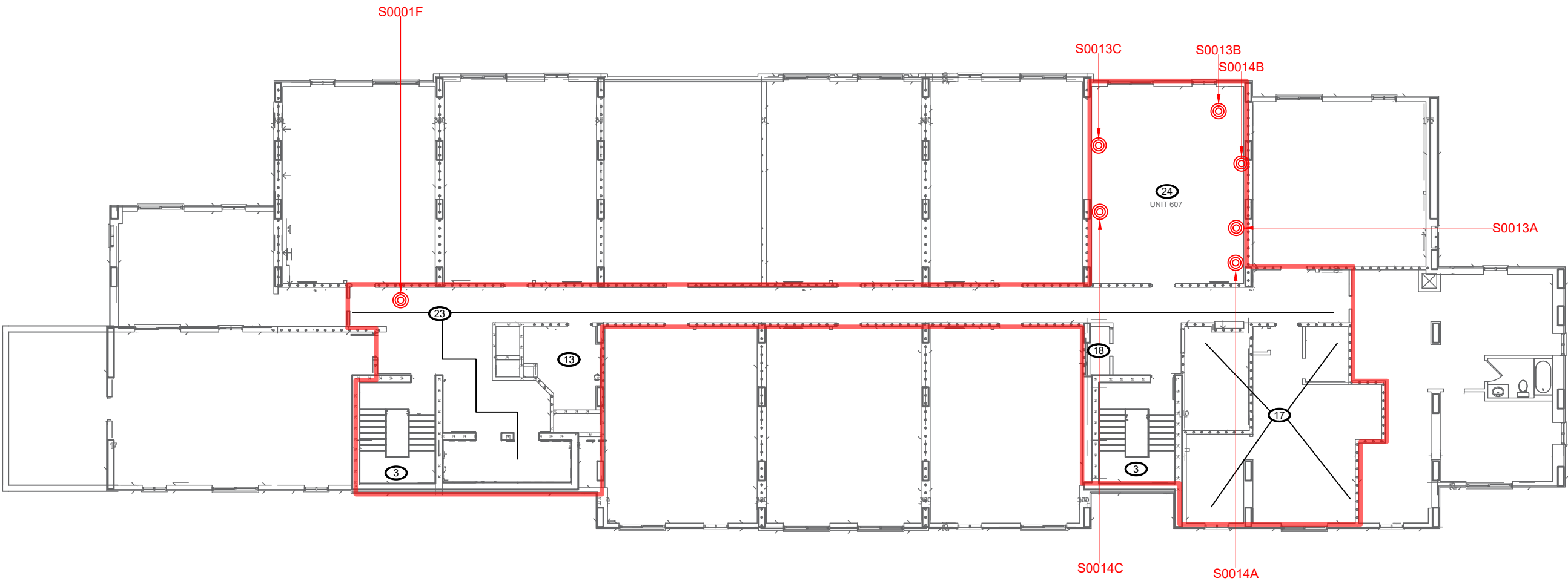
PROJECT NAME:
ASBESTOS ASSESSMENT

CLIENT NAME:
HALTON REGION

PROJECT LOCATION:
ALDRSHOT VILLAGE SENIORS
RESIDENCE, 540 PLAINS RD
BURLINGTON, ON

FIGURE NAME:
FIFTH FLOOR

PROJECT NUMBER: 320580.001	SCALE: NOT TO SCALE
DRAWN BY: NM	REVIEWED BY: PINCHIN LTD.
DATE: AUGUST 2023	FIGURE NUMBER: 5 OF 6



LEGEND

- PINCHIN LOCATION NUMBER
- ASBESTOS BULK SAMPLE
- SURVEY BOUNDARY/ASSESSED AREA

NOT ALL KNOWN OR SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE ASBESTOS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED ASBESTOS-CONTAINING BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

BASE PLAN PROVIDED BY CLIENT.



PROJECT NAME:
ASBESTOS ASSESSMENT

CLIENT NAME:
HALTON REGION

PROJECT LOCATION:
ALDRSHOT VILLAGE SENIORS
RESIDENCE, 540 PLAINS RD
BURLINGTON, ON

FIGURE NAME:
SIXTH FLOOR

PROJECT NUMBER: 320580.001	SCALE: NOT TO SCALE
DRAWN BY: NM	REVIEWED BY: PINCHIN LTD.
DATE: AUGUST 2023	FIGURE NUMBER: 6 OF 6

APPENDIX II
Asbestos Analytical Certificates



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and
40 CFR, Part 763, Subpart E, App.E



Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10024817

Analysis: PLM

Date Received: 06/05/2023

Date Reported: 06/13/2023

Date Amended: 06/13/2023

Project: Hlaton Building 24 Aldershot Village

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0001A	Wall,Drywall And Joint Compound,Loc:1,Vestibule	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0001					Crushed
S0001B	Wall,Drywall And Joint Compound,Loc:4,Lobby	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0002					Crushed
S0001C	Wall,Drywall And Joint Compound,Loc:5,Garbage	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0003					Crushed
S0001D	Wall,Drywall And Joint Compound,Loc:4,Lobby	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0004					Crushed
S0001E	Wall,Drywall And Joint Compound,Loc:7,Apartment Managers Office	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0005					Crushed
S0001F	Wall,Drywall And Joint Compound,Loc:23,6th Floor Corridor	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0061					Crushed
S0001G	Wall,Drywall And Joint Compound,Loc:21,5th Floor Corridor	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0062					Crushed
S0002A	Wall,Paint,Concrete Block,Loc:5,Garbage	None Detected		100% Other	White, Gray Non-Fibrous Heterogeneous
10024817_0006					Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogenous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Yanelis Delgado (64)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and
40 CFR, Part 763, Subpart E, App.E



Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10024817

Analysis: PLM

Date Received: 06/05/2023

Date Reported: 06/13/2023

Date Amended: 06/13/2023

Project: Hlaton Building 24 Aldershot Village

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0002B	Wall,Paint,Concrete Block,Loc:5,Garbage	None Detected		100% Other	Gray, White Non-Fibrous Heterogeneous
10024817_0007					Crushed
S0002C	Wall,Paint,Concrete Block,Loc:5,Garbage	None Detected		100% Other	White, Gray Non-Fibrous Heterogeneous
10024817_0008					Crushed
S0002D	Wall,Paint,Concrete Block,Loc:3,Stairwells	None Detected		100% Other	White, Gray Non-Fibrous Heterogeneous
10024817_0009					Crushed
S0002E	Wall,Paint,Concrete Block,Loc:3,Stairwells	None Detected		100% Other	White, Gray Non-Fibrous Heterogeneous
10024817_0010					Crushed
S0003A	Structure,Fireproofing (fibrous),Loc:8,Corridor 2nd Floor	None Detected		90% Other 10% Vermiculite	Gray Non-Fibrous Heterogeneous
10024817_0011					Teased
S0003B	Structure,Fireproofing (fibrous),Loc:8,Corridor 2nd Floor	None Detected		90% Other 10% Vermiculite	Gray Non-Fibrous Heterogeneous
10024817_0012					Teased
S0003C	Structure,Fireproofing (fibrous),Loc:21,5th Floor Corridor	None Detected		90% Other 10% Vermiculite	Gray Non-Fibrous Heterogeneous
10024817_0013					Teased
S0003D	Structure,Fireproofing (fibrous),Loc:14,Corridor 3rd Floor	None Detected		90% Other 10% Vermiculite	Gray Non-Fibrous Heterogeneous
10024817_0063					Teased

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Yanelis Delgado (64)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and
40 CFR, Part 763, Subpart E, App.E



Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10024817

Analysis: PLM

Date Received: 06/05/2023

Date Reported: 06/13/2023

Date Amended: 06/13/2023

Project: Hlaton Building 24 Aldershot Village

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0003E	Structure, Fireproofing (fibrous), Loc: 19, Corridor 4th Floor	None Detected		90% Other 10% Vermiculite	Gray Non-Fibrous Heterogeneous
10024817_0064					Teased
S0003F	Structure, Fireproofing (fibrous), Loc: 19, Corridor 4th Floor	None Detected		90% Other 10% Vermiculite	Gray Non-Fibrous Heterogeneous
10024817_0014					Teased
S0003G	Structure, Fireproofing (fibrous), Loc: 19, Corridor 4th Floor	None Detected		90% Other 10% Vermiculite	Gray Non-Fibrous Heterogeneous
10024817_0015					Teased
S0004A	Ceiling, Texture Coat, Loc: 9, Amenity Room	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0016					Crushed
S0004B	Ceiling, Texture Coat, Loc: 9, Amenity Room	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0017					Crushed
S0004C	Ceiling, Texture Coat, Loc: 9, Amenity Room	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0018					Crushed
S0005A	Wall, Drywall And Joint Compound, Loc: 15, Unit 302	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0019					Crushed
S0005B	Wall, Drywall And Joint Compound, Loc: 15, Unit 302	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0020					Crushed

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Yanelis Delgado (64)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and
40 CFR, Part 763, Subpart E, App.E



Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10024817

Analysis: PLM

Date Received: 06/05/2023

Date Reported: 06/13/2023

Date Amended: 06/13/2023

Project: Hlaton Building 24 Aldershot Village

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0005C	Wall,Drywall And Joint Compound,Loc:15,Unit 302	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0021					Crushed
S0006A	Ceiling,Texture Coat,Loc:15,Unit 302	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0022					Crushed
S0006B	Ceiling,Texture Coat,Loc:15,Unit 302	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0023					Crushed
S0006C	Ceiling,Texture Coat,Loc:15,Unit 302	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0024					Crushed
S0007A	Wall,Drywall And Joint Compound,Loc:16,Unit 307	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0025					Crushed
S0007B	Wall,Drywall And Joint Compound,Loc:16,Unit 307	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0026					Crushed
S0007C	Wall,Drywall And Joint Compound,Loc:16,Unit 307	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0027					Crushed
S0008A	Ceiling,Texture Coat,Loc:16,Unit 307	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0028					Crushed

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Yanelis Delgado (64)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and
40 CFR, Part 763, Subpart E, App.E



Customer: Pinchin Ltd.
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Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10024817

Analysis: PLM

Date Received: 06/05/2023

Date Reported: 06/13/2023

Date Amended: 06/13/2023

Project: Hlaton Building 24 Aldershot Village

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0008B	Ceiling,Texture Coat,Loc:16,Unit 307	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0029					Crushed
S0008C	Ceiling,Texture Coat,Loc:16,Unit 307	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0030					Crushed
S0009A	Wall,Drywall And Joint Compound,Loc:20,Unit 405	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0031					Crushed
S0009B	Wall,Drywall And Joint Compound,Loc:20,Unit 405	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0032					Crushed
S0009C	Wall,Drywall And Joint Compound,Loc:20,Unit 405	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0033					Crushed
S0010A	Ceiling,Texture Coat,Loc:20,Unit 405	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0034					Crushed
S0010B	Ceiling,Texture Coat,Loc:20,Unit 405	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0035					Crushed
S0010C	Ceiling,Texture Coat,Loc:20,Unit 405	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0036					Crushed

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Yanelis Delgado (64)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and
40 CFR, Part 763, Subpart E, App.E



Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10024817

Analysis: PLM

Date Received: 06/05/2023

Date Reported: 06/13/2023

Date Amended: 06/13/2023

Project: Hlaton Building 24 Aldershot Village

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0011A	Wall,Drywall And Joint Compound,Loc:22,Unit 501	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0037					Crushed
S0011B	Wall,Drywall And Joint Compound,Loc:22,Unit 501	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0038					Crushed
S0011C	Wall,Drywall And Joint Compound,Loc:22,Unit 501	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0039					Crushed
S0012A	Ceiling,Texture Coat,Loc:22,Unit 501	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0040					Crushed
S0012B	Ceiling,Texture Coat,Loc:22,Unit 501	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0041					Crushed
S0012C	Ceiling,Texture Coat,Loc:22,Unit 501	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0042					Crushed
S0013A	Wall,Drywall And Joint Compound,Loc:24,Unit 607	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0043					Crushed
S0013B	Wall,Drywall And Joint Compound,Loc:24,Unit 607	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0044					Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogenous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Yanelis Delgado (64)

Analyst

Nathaniel J. Durham

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and
40 CFR, Part 763, Subpart E, App.E



Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10024817

Analysis: PLM

Date Received: 06/05/2023

Date Reported: 06/13/2023

Date Amended: 06/13/2023

Project: Hlaton Building 24 Aldershot Village

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0013C	Wall,Drywall And Joint Compound,Loc:24,Unit 607	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0045					Crushed
S0014A	Ceiling,Texture Coat,Loc:24,Unit 607	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0046					Crushed
S0014B	Ceiling,Texture Coat,Loc:24,Unit 607	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0047					Crushed
S0014C	Ceiling,Texture Coat,Loc:24,Unit 607	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0048					Crushed
S0015A	Wall,Drywall And Joint Compound,Loc:10,Unit 502	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0049					Crushed
S0015B	Wall,Drywall And Joint Compound,Loc:10,Unit 502	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0050					Crushed
S0015C	Wall,Drywall And Joint Compound,Loc:10,Unit 502	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0051					Crushed
S0016A	Ceiling,Texture Coat,Loc:10,Unit 502	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0052					Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogenous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Yanelis Delgado (64)

Analyst

Approved Signatory



Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and
40 CFR, Part 763, Subpart E, App.E



Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10024817

Analysis: PLM

Date Received: 06/05/2023

Date Reported: 06/13/2023

Date Amended: 06/13/2023

Project: Hlaton Building 24 Aldershot Village

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0016B	Ceiling,Texture Coat,Loc:10,Unit 502	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0053					Crushed
S0016C	Ceiling,Texture Coat,Loc:10,Unit 502	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0054					Crushed
S0017A	Wall,Drywall And Joint Compound,Loc:11,Unit 209	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0055					Crushed
S0017B	Wall,Drywall And Joint Compound,Loc:11,Unit 209	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0056					Crushed
S0017C	Wall,Drywall And Joint Compound,Loc:11,Unit 209	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0057					Crushed
S0018A	Ceiling,Texture Coat,Loc:11,Unit 209	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0058					Crushed
S0018B	Ceiling,Texture Coat,Loc:11,Unit 209	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0059					Crushed
S0018C	Ceiling,Texture Coat,Loc:11,Unit 209	None Detected		100% Other	White Non-Fibrous Homogeneous
10024817_0060					Crushed

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Yanelis Delgado (64)

Analyst

Nathaniel J. Durham

Approved Signatory

10024817
Revised

Version 1-15-2012

Client:	Pinchin Ltd.	Instructions: Use Column "B" for your contact info To See an Example Click the bottom Example Tab 64 Begin Samples with a "<<" above the first sample and end with a ">>" below the last sample. Only Enter your data on the first sheet "Sheet1" Note: Data 1 and Data 2 are optional fields that do not show up on the official report, however they will be included in the electronic data returned to you to facilitate your reintegration of the report data.	Scientific Analytical Institute  4604 Dundas Dr. Greensboro, NC 27407 Phone: 336.292.3888 Fax: 336.292.3313 Email: lab@sailab.com
Contact:	Justin Appleby / Leslie Heywood		
Address:	ON		
Phone:			
Fax:			
Email:	jappleby@pinchin.com lheywood@pinchin.com		
Project:	Halton Building 24 No Stop Positives. Perform ashing on third vinyl floor tile if first two are ND.		
Client Notes:			
P.O. #:	320580.001		
Date Submitted:	06-13-2023		
Analysis:	PLM BULK EPA 600		
TurnAroundTime:	6+ days		

<<

S0001A	Wall,Drywall And Joint Compound,Loc:1,Vestibule
S0001B	Wall,Drywall And Joint Compound,Loc:4,Lobby
S0001C	Wall,Drywall And Joint Compound,Loc:5,Garbage
S0001D	Wall,Drywall And Joint Compound,Loc:4,Lobby
S0001E	Wall,Drywall And Joint Compound,Loc:7,Apartment Managers Office
S0001F	Wall,Drywall And Joint Compound,Loc:23,6th Floor Corridor
S0001G	Wall,Drywall And Joint Compound,Loc:21,5th Floor Corridor
S0002A	Wall,Paint,Concrete Block,Loc:5,Garbage
S0002B	Wall,Paint,Concrete Block,Loc:5,Garbage
S0002C	Wall,Paint,Concrete Block,Loc:5,Garbage
S0002D	Wall,Paint,Concrete Block,Loc:3,Stairwells
S0002E	Wall,Paint,Concrete Block,Loc:3,Stairwells
S0003A	Structure,Fireproofing (fibrous),Loc:8,Corridor 2nd Floor
S0003B	Structure,Fireproofing (fibrous),Loc:8,Corridor 2nd Floor
S0003C	Structure,Fireproofing (fibrous),Loc:21,5th Floor Corridor
S0003D	Structure,Fireproofing (fibrous),Loc:14,Corridor 3rd Floor
S0003E	Structure,Fireproofing (fibrous),Loc:19,Corridor 4th Floor
S0003F	Structure,Fireproofing (fibrous),Loc:19,Corridor 4th Floor
S0003G	Structure,Fireproofing (fibrous),Loc:19,Corridor 4th Floor
S0004A	Ceiling,Texture Coat,Loc:9,Amenity Room
S0004B	Ceiling,Texture Coat,Loc:9,Amenity Room
S0004C	Ceiling,Texture Coat,Loc:9,Amenity Room
S0005A	Wall,Drywall And Joint Compound,Loc:15,Unit 302
S0005B	Wall,Drywall And Joint Compound,Loc:15,Unit 302
S0005C	Wall,Drywall And Joint Compound,Loc:15,Unit 302
S0006A	Ceiling,Texture Coat,Loc:15,Unit 302
S0006B	Ceiling,Texture Coat,Loc:15,Unit 302
S0006C	Ceiling,Texture Coat,Loc:15,Unit 302
S0007A	Wall,Drywall And Joint Compound,Loc:16,Unit 307
S0007B	Wall,Drywall And Joint Compound,Loc:16,Unit 307
S0007C	Wall,Drywall And Joint Compound,Loc:16,Unit 307
S0008A	Ceiling,Texture Coat,Loc:16,Unit 307
S0008B	Ceiling,Texture Coat,Loc:16,Unit 307
S0008C	Ceiling,Texture Coat,Loc:16,Unit 307
S0009A	Wall,Drywall And Joint Compound,Loc:20,Unit 405
S0009B	Wall,Drywall And Joint Compound,Loc:20,Unit 405
S0009C	Wall,Drywall And Joint Compound,Loc:20,Unit 405
S0010A	Ceiling,Texture Coat,Loc:20,Unit 405
S0010B	Ceiling,Texture Coat,Loc:20,Unit 405
S0010C	Ceiling,Texture Coat,Loc:20,Unit 405
S0011A	Wall,Drywall And Joint Compound,Loc:22,Unit 501
S0011B	Wall,Drywall And Joint Compound,Loc:22,Unit 501
S0011C	Wall,Drywall And Joint Compound,Loc:22,Unit 501
S0012A	Ceiling,Texture Coat,Loc:22,Unit 501
S0012B	Ceiling,Texture Coat,Loc:22,Unit 501
S0012C	Ceiling,Texture Coat,Loc:22,Unit 501
S0013A	Wall,Drywall And Joint Compound,Loc:24,Unit 607
S0013B	Wall,Drywall And Joint Compound,Loc:24,Unit 607

 Accepted ☒
 Rejected ☐

 Bohlen
 6/13
 12pm

100241817
R

S0013C	Wall,Drywall And Joint Compound,Loc:24,Unit 607
S0014A	Ceiling,Texture Coat,Loc:24,Unit 607
S0014B	Ceiling,Texture Coat,Loc:24,Unit 607
S0014C	Ceiling,Texture Coat,Loc:24,Unit 607
S0015A	Wall,Drywall And Joint Compound,Loc:10,Unit 502
S0015B	Wall,Drywall And Joint Compound,Loc:10,Unit 502
S0015C	Wall,Drywall And Joint Compound,Loc:10,Unit 502
S0016A	Ceiling,Texture Coat,Loc:10,Unit 502
S0016B	Ceiling,Texture Coat,Loc:10,Unit 502
S0016C	Ceiling,Texture Coat,Loc:10,Unit 502
S0017A	Wall,Drywall And Joint Compound,Loc:11,Unit 209
S0017B	Wall,Drywall And Joint Compound,Loc:11,Unit 209
S0017C	Wall,Drywall And Joint Compound,Loc:11,Unit 209
S0018A	Ceiling,Texture Coat,Loc:11,Unit 209
S0018B	Ceiling,Texture Coat,Loc:11,Unit 209
S0018C	Ceiling,Texture Coat,Loc:11,Unit 209
>>	

APPENDIX III
Methodology



1.0 GENERAL

An inspection was conducted to identify the asbestos-containing materials (ACM) incorporated in the structure and its finishes as defined by the scope of work.

Information regarding the location and condition of ACM encountered and visually estimated quantities were recorded. The locations of any samples collected were recorded on small-scale plans. As-built drawings and previous reports were referenced where provided.

Sample collection was conducted in accordance with our Standard Operating Procedures.

The inspection for asbestos included friable and non-friable asbestos-containing materials (ACM). A friable material is a material that when dry can be crumbled, pulverized or powdered by hand pressure.

A separate set of samples was collected of each type of homogenous material suspected to contain asbestos. A homogenous material is defined by the US EPA as material that is uniform in texture and appearance, was installed at one time, and is unlikely to consist of more than one type or formulation of material. The homogeneous materials were determined by visual examination and available information on the phases of construction and prior renovations.

Samples were collected at a rate that is in compliance with the requirements of local regulations and guidelines. In some cases, manufactured products such as asbestos cement pipe were visually identified without sample confirmation.

The analysis was performed in accordance with Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, July 1993.

Analytical results were compared to the following criteria.

Jurisdiction*	Friable	Non-Friable
Ontario	0.5%	0.5%

Where building materials are described in the report as “non-asbestos” or “does not contain asbestos”, this means that either no asbestos was detected by the analytical method utilized in any of the multiple samples or, if detected, it is below the lower limit of an asbestos-containing material in the applicable regulation. Additionally, these terms are used for materials which historically are known to not include asbestos in their manufacturing.

Asbestos materials were evaluated in order to make recommendations regarding remedial work. The priority for remedial action was based on several factors:

- Friability (friable or non-friable);



- Condition (good, fair, poor, debris);
- Accessibility (ranking from accessible to all building users to inaccessible);
- Visibility (whether the material is obscured by other building components).
- Efficiency of the work (for example, if damaged ACM is being removed in an area, it may be most practical to remove all ACM in the area even if it is in good condition).

For a complete description of the Evaluation Criteria and Basis of Recommendations, refer to Annex A.

Template: Methodology for Asbestos Assessment, HAZ, July 22, 2021

METHODOLOGY ANNEX A EVALUATION CRITERIA



1.0 EVALUATION CRITERIA AND BASIS OF RECOMMENDATIONS

The detailed asbestos assessment provides information regarding the location, condition, accessibility and friability of the asbestos-containing materials (ACM). In order to make recommendations for compliance with current regulations, Pinchin developed the following criteria.

2.0 EVALUATION OF CONDITION

2.1 Friable Sprayed or Trowelled Fireproofing, Thermal Insulation and Texture Finishes (Surfacing Materials)

To evaluate the condition of ACM sprayed or trowelled on fireproofing, sprayed or trowelled thermal insulation (non-mechanical), or texture, decorative or acoustic finishes, the following criteria are applied:

Good	Surface of material shows no significant signs of damage, deterioration or delamination. Good condition includes unencapsulated or unpainted fireproofing or texture finishes, where no or limited delamination or damage is observed, or encapsulated fireproofing or texture finishes where the encapsulant or paint has been applied after the damage or fallout occurred.
Poor	A sprayed material that shows signs of significant damage or is significantly delaminating or deteriorating. This may be limited to surface delamination or some portion of the substrate may be exposed.

In Locations where damage exists in isolated areas, both good and poor condition may be applicable.

The extent of each condition will be recorded. Fair condition is not utilized in the evaluation of ACM sprayed or trowelled fireproofing, sprayed or trowelled thermal insulation (non-mechanical), or texture, decorative or acoustic finishes.

The evaluation of the above products above ceilings may be limited by the number of observations and by building components such as ducts or full height walls that obstruct the above ceiling observations.

2.2 Friable Mechanical or Thermal System Insulation (TSI)

To evaluate the condition of mechanical insulation on vessels, boilers, breeching, ducts, pipes, fan units, equipment etc. the following criteria are applied:

Good	Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where the jacketing has minor damage (i.e. scuffs or stains), but the jacketing is not penetrated.
Fair	Minor penetrating damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that has never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges from minor to none. Damage can be repaired.



Poor	Original insulation jacket is missing, damaged, deteriorated or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired. Includes components where insulation may have been removed incompletely.

The evaluation of mechanical insulation may be limited by the number of observations made and building components such as ducts or full height walls that obstruct observations. It is often not possible to observe each foot of mechanical insulation from all angles.

2.3 Potentially Friable Materials and Miscellaneous Friable Materials

Potentially friable ACM are products that are basically non-friable while in place but have the potential to generate friable dust upon removal or if significantly disturbed without appropriate procedures. These products may become friable if damaged. Potentially friable materials include materials such as acoustic ceiling tiles and plaster. To evaluate the condition of potentially friable materials, the following criteria are applied:

Good	No significant damage or deterioration. Still serving its intended use as a building material or finish.
Fair	Showing signs of some cracking or breakage, but is not deteriorating (e.g. cracked plaster, broken but in place ceiling tile, missing tile or section of plaster etc.). The condition is such that it is still serving its intended use as a building material or finish but may require repair for mainly cosmetic purposes.
Poor	Significant deterioration or breaking apart of the material. Material has deteriorated to the point it is not serving its intended use as building material or finish. Material has deteriorated to a point it has become friable. Normally potentially friable ACM in Poor condition is not repairable and requires at least localized removal and replacement.

2.4 Non-Friable Materials

Non-friable ACM cover a wide range of products with a wide variation in their tendency to release dust or asbestos fibres to the air. Many of these materials, (particularly where the matrix is an unweathered bitumen, asphalt or tar material) do not release fibres except in very unusual circumstances or during significant disturbance (e.g. use of abrasive power tools). Others with a cementitious matrix (asbestos-cement products) can more readily release dust due to abrasion, demolition, weathering, etc. The potential for asbestos release from non-friable ACM is always lower than from friable ACM. To evaluate the condition of non-friable Materials, the following criteria are applied:

Good	No significant damage or deterioration. Still serving its intended use as a building material or finish.



Fair	Showing signs of some cracking or breakage but is not deteriorating (e.g. cracked vinyl floor tile, missing piece of tile or transite, etc.). The condition is such that it is still serving its intended use as a building material or finish but may require repair for mainly cosmetic purposes.
Poor	Significant deterioration or breaking apart of the material to the point at which it cannot be repaired, and it will require at least local removal. Material has deteriorated to the point it is not serving its intended use as building material or finish. Material may have deteriorated to a point where traffic or disturbance may cause it to become friable.

2.5 Evaluation of ACM Debris

The identification of the exact location or presence of debris on the top of ceiling tiles is limited by the number of observations made and the presence of building components such as ducts or full height walls that obstruct observations.

The presence of fallen or dislodged ACM is noted separately from the ACM source and is referred to as Debris. Debris may be friable if from a friable ACM source or a badly deteriorated non-friable ACM source. Debris may also be non-friable (such as fallen pieces of transite sheet or mastic fittings, or broken, dislodged floor tiles).

Debris	Debris may be friable or non-friable but is always identified as debris.

2.6 Evaluation of Presumed Asbestos-Containing Material (PACM)

Presumed asbestos-containing materials (PACM), are building materials that may contain asbestos but were not sampled or analyzed due to inaccessibility or the need to perform destructive testing to obtain a reasonable sample set. Evaluation of these materials is based on the assumption that these PACM are asbestos-containing.

A list of PACM is provided in the report and they are generally not included in the detailed room by room reports. Typically, they are excluded because they are inaccessible or present in very small quantities. If PACM are evaluated, Pinchin uses the criteria that correspond with the type (and friability) of the material listed above.



3.0 EVALUATION OF ACCESSIBILITY

The accessibility of building materials known or suspected of being ACM is rated according to the following criteria:

Access (A)	Common areas of the building within reach of all building users (approximately 8' - 9' from floor or standard ceiling height). Includes other areas where occupant activities may result in disturbance of material that is not normally within reach from floor level, but may be disturbed by common activities (e.g. gymnasiums, workshops, warehouses)
Access (B)	Areas of the building accessed primarily by Maintenance/Caretaking/Janitorial Staff and within reach without use of a ladder. Includes areas within reach in Boiler Rooms, Electrical Rooms, Janitors Closets, Elevator Rooms, Mechanical Rooms, etc. Includes materials within reach from fixed ladders or catwalks, mezzanines, and accessible pipe chases.
Access (C) and Visible	Areas of the building above 8' - 9' where use of a ladder or scaffold is required to reach the ACM. Only includes ACM that are visible to view without the removal or opening of other building components such as ceiling tiles or service access panels. Visible column on HMIS sheets will say YES.
Access (C) and not Visible	Areas of the building above 8' - 9' where use of a ladder or scaffold is required to reach the ACM. Includes ACM that are not visible to view and require the removal of a building component to see, such as ceilings tiles or access panels to view and access. Includes rarely entered crawl spaces, attic spaces, etc. Observations will be limited to the extent visible from the access points. Visible column on HMIS sheets will say NO.
Access (D)	Areas of the building behind inaccessible solid ceiling systems, walls or equipment etc. where demolition of the ceiling, wall or equipment etc. is required to reach the ACM. Material inaccessible due to height or location or is only accessed under unusual situations. Evaluation of condition and extent of ACM is limited or impossible, depending on the surveyor's ability to visually examine materials in Access D.

4.0 ACTION MATRIX AND DEFINITIONS

Pinchin's evaluation of the viability of a specific asbestos control option is based on the consideration of the friability, condition, accessibility and visibility of a material. The logic used is that damaged ACM located in an area frequently accessed by all building occupants is of a higher priority than damaged ACM located in an infrequently accessed service area. The action matrix considers the potential for fibre release (primarily from friable ACM) and the possible concerns from regulatory bodies and many building occupants to all damaged ACM (including non-friable).

In any building with asbestos, many current regulations require an Asbestos Management Program be implemented. Depending on the condition and the accessibility, more active measures such as repair or removal may be recommended. The following matrix provides guidance for recommended Actions in the absence of renovation or demolition. In the event of construction or maintenance activity which will disturb ACM more aggressive control or removal will be required.



4.1 Action Matrix

The following tables outline the action decisions based on the relationship of assessed factors. Table I applies to friable ACM. Table II applies to non-friable ACM.

Table I Decision Matrix for Friable ACM

Access	Condition			Debris
	Good	Fair	Poor	
(A)	Action 5 ¹	Action 5 ²	Action 3	Action 1
(B)	Action 7	Action 6 ³	Action 3	Action 1
(C) Visible	Action 7	Action 6	Action 3	Action 2
(C) Not Visible	Action 7	Action 7	Action 4	Action 2
(D)	Action 7	Action 7	Action 7	Action 7

Table II Decision Matrix for Potentially Friable and Non-Friable ACM

Access	Condition			Debris
	Good	Fair	Poor	
(A)	Action 7	Action 7 ⁴	Action 3	Action 1
(B)	Action 7	Action 7	Action 3	Action 1
(C) Visible	Action 7	Action 7	Action 4	Action 2
(C) Not Visible	Action 7	Action 7	Action 4	Action 2
(D)	Action 7	Action 7	Action 7	Action 7

4.2 Action Definitions

The following are the definitions in the Action Matrix Table presented above:

Action Definitions

Action 1	Clean-Up of ACM Debris Restrict access that is likely to cause a disturbance of the ACM Debris and clean up ACM Debris. Utilize appropriate asbestos precautions.

¹ If friable ACM in access (A)/Good condition is not proactively removed Action 7 (Manage) is recommended.

² If friable ACM in access (A)/Fair condition is not proactively removed repair is recommended.

³ If friable ACM in access (B)/Fair condition is likely to be disturbed after repair proactive removal is recommended.

⁴ Action 7 is recommended for all non-friable ACM in Fair condition however some clients may wish to repair or take some action primarily for cosmetic reasons



Action Definitions

Action 2	Precautions for Access Which may Disturb ACM Debris Use appropriate means to isolate the debris or to limit entry to the area which may disturb the material. At locations where ACM Debris can remain in place in lieu of removal or clean-up (e.g. Debris on top of ceiling tiles or behind lockable door), Utilize appropriate asbestos precautions to enter the area if this will disturb debris. The precautions will be required until the ACM Debris has been cleaned up.
Action 3	ACM Removal Remove ACM. Utilize asbestos procedures appropriate to the scope of the removal work. Until it is removed, restrict access to the material so it is not disturbed.
Action 4	Precautions for Work Which may Disturb ACM in Poor Condition. Utilize appropriate asbestos precautions if ACM may be disturbed by work on or near ACM. This does not require restricting access to the area, only control of work which may contact or disturb the ACM. Removal is the only viable option if work will disturb ACM.
Action 5	Proactive ACM Removal Remove friable ACM where the presence of friable asbestos in Good condition is not desirable. If friable ACM in Fair condition is not removed, then Repair friable ACM.
Action 6	ACM Repair Repair friable ACM in Fair condition which is not likely to be damaged again or disturbed by normal use of the area or room. Pinchin recommends proactive removal if friable ACM is likely to be damaged or disturbed during normal use of the area or room
Action 7	Asbestos Management Program with Routine Surveillance Implement an Asbestos Management Program, including routine surveillance of ACM. Reassess materials regularly (typically once per year).

Master Template: Methodology Annex A to Appendix I Evaluation Criteria, HAZ, January 10, 2020

APPENDIX IV
Location Summary Report



LOCATIONS LIST



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors Residence

Survey Date:

Last Re-Assessment:

Building Phases: A: 2011

Location No.	Name or Description	Area ft ²	Floor No.	Bldg. Phase	Notes
1	Vestibule	88	1	A	
2	Open Area	8000	1	A	
3	Stairwells	0		A	
4	Lobby	450	1	A	
5	Garbage	250	1	A	
6	Storage Room	400	1	A	
7	Apartment Managers Office	250	1	A	
8	Corridor 2nd Floor	2000	2	A	
9	Amenity Room	2500	2	A	
10	Unit 502	600	2	A	
11	Unit 209	600	2	A	
12	Office	600	2	A	
13	Garbage Rooms	350		A	
14	Corridor 3rd Floor	2000	3	A	
15	Unit 302	600	3	A	
16	Unit 307	600	3	A	
17	Laundry Rooms	220	1/2	A	
18	Electrical Closets	60		A	
19	Corridor 4th Floor	2000	4	A	
20	Unit 405	600	4	A	
21	5th Floor Corridor	2000	5	A	
22	Unit 501	600	5	A	
23	6th Floor Corridor	2000	6	A	
24	Unit 607	600	6	A	

APPENDIX V

Asbestos Material Summary Report / Sample Log



HAZARDOUS MATERIALS SUMMARY / SAMPLE LOG



1.855.PINCHIN www.pinchin.com

Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors Residence

Survey Date:

HAZMAT	Sample No	System/Component/Material/Sample Description	Locations	Bldg. Phase	LF	SF	EA	%	Type	Positive	Friability
Asbestos	S0001 ABCDEFGH	Wall, Ceiling, Wall Drywall And Joint Compound	1,2,4,5,6,7,8,9,12,13,14,17,19,21,23	A	0	17418	0	0	None Detected	No	
Asbestos	S0002 ABCDE	Wall Paint Concrete Block	3,5	A	0	2500	0	0	None Detected	No	
Asbestos	S0003 ABCDEFGH	Structure Fireproofing (fibrous)	8,14,19,21,23	A	0	10000	0	0	None Detected	No	
Asbestos	S0004 ABC	Ceiling Texture Coat	9,12	A	0	4000	0	0	None Detected	No	
Asbestos	S0005 ABC	Wall, Ceiling Drywall And Joint Compound	15	A	0	1500	0	0	None Detected	No	
Asbestos	S0006 ABC	Ceiling Texture Coat	15	A	0	600	0	0	None Detected	No	
Asbestos	S0007 ABC	Wall, Ceiling Drywall And Joint Compound	16,20,22	A	0	2700	0	0	None Detected	No	
Asbestos	S0008 ABC	Ceiling Texture Coat	16	A	0	600	0	0	None Detected	No	
Asbestos	S0009 ABC	Wall Drywall And Joint Compound	20	A	0	900	0	0	None Detected	No	
Asbestos	S0010 ABC	Ceiling Texture Coat	20	A	0	600	0	0	None Detected	No	
Asbestos	S0011 ABC	Wall Drywall And Joint Compound	22	A	0	900	0	0	None Detected	No	
Asbestos	S0012 ABC	Ceiling Texture Coat	22	A	0	600	0	0	None Detected	No	
Asbestos	S0013 ABC	Wall, Ceiling Drywall And Joint Compound	24	A	0	1500	0	0	None Detected	No	
Asbestos	S0014 ABC	Ceiling Texture Coat	24	A	0	600	0	0	None Detected	No	
Asbestos	S0015 ABC	Wall, Ceiling Drywall And Joint Compound	10	A	0	1500	0	0	None Detected	No	
Asbestos	S0016 ABC	Ceiling Texture Coat	10	A	0	600	0	0	None Detected	No	
Asbestos	S0017 ABC	Wall, Ceiling Drywall And Joint Compound	11	A	0	1500	0	0	None Detected	No	
Asbestos	S0018 ABC	Ceiling Texture Coat	11	A	0	600	0	0	None Detected	No	
Asbestos	V9500	Floor Mortar Thin-set	1,2,4,7,8,9,10,11,12,13,14,15,16,17,19,20,21 22,23,24	A	0	9958	0	0	Presumed Asbestos	Yes	NF
Asbestos	V9500	Wall Mortar Thin-set	2,14,17,19,21,23,24	A	0	750	0	0	Presumed Asbestos	Yes	NF
Asbestos	V0000	Ceiling Ceiling Tiles (lay-in) 24x24 Pinhole With Fleck	2	A	0	0	0	0	Non Asbestos	No	
Asbestos	V0000	Ceiling Ceiling Tiles (lay-in) 24x24 Textured	2,7,8,14,19,21,23	A	0	0	0	0	Non	No	

2023-08-14

Quantities shown above are based on visual approximations only and may be subject to variation. Copyright Pinchin Ltd. 2023

Page 1 of 3.



HAZARDOUS MATERIALS SUMMARY / SAMPLE LOG



HAZMAT	Sample No	System/Component/Material/Sample Description	Locations	Bldg. Phase	LF	SF	EA	%	Type	Positive	Friability
									Asbestos		



HAZARDOUS MATERIALS SUMMARY / SAMPLE LOG

**Legend:**

Sample number		Units			
S####	Asbestos sample collected	SF	Square feet	NF	Non Friable material.
L####	Paint sample collected	LF	Linear feet	F	Friable material
P####	PCB sample collected	EA	Each	PF	Potentially Friable material
M####	Mould sample collected	%	Percentage		
V####	Material visually similar to numbered sample collected				
V0000	Known non Hazardous Material				
V9000	Material is visually identified as Hazardous Material				
V9500	Material is presumed to be Hazardous Material				
[Loc. No.]	Abated Material				

APPENDIX VI
HMIS Data Report



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #1 : Vestibule

Floor: 1

Residence

Room #:

Area (sqft): 88

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		88			SF	V0001	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		88(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		120			SF	S0001A	None Detected	N.D.	None	

Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #2 : Open Area

Floor: 1

Residence

Room #:

Area (sqft): 8000

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling ¹		Ceiling Tiles (lay-in), 24x24 textured			C	Y						V0000	Non-Asbestos		None	
Ceiling ²		Ceiling Tiles (lay-in), 24x24 pinhole with fleck			C	Y						V0000	Non-Asbestos		None	
Duct	Not Accessible															
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		300(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Floor		Rubber			A	Y										
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		120			SF	V0001	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										
Wall		Mortar, Thin-set			D	N		100(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF



ALL DATA REPORT



2 - 2011



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #3 : Stairwells

Floor:

Residence

Room #:

Area (sqft): 0

Survey Date: 2023-05-30

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Duct	Not Accessible															
Floor		Concrete (poured)			A	Y										
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure		Metal			C	N										
Wall		Concrete (poured)			A	Y										
Wall		Masonry			A	Y										
Wall		Paint, Concrete block			A	Y		2000			SF	S0002DE	None Detected	N.D.	None	

Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #4 : Lobby

Floor: 1

Residence

Room #:

Area (sqft): 450

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		450			SF	V0001	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		450(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		800			SF	S0001BD	None Detected	N.D.	None	



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #5 : Garbage

Floor: 1

Residence

Area (sqft): 250

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		250			SF	V0001	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Concrete (poured)			A	Y										
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		400			SF	S0001C	None Detected	N.D.	None	
Wall		Masonry			A	Y										
Wall		Paint, Concrete block			A	Y		500			SF	S0002ABC	None Detected	N.D.	None	

Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #6 : Storage Room

Floor: 1

Residence

Area (sqft): 400

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		400			SF	V0001	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Concrete (poured)			A	Y										
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible				C	N										
Wall		Concrete (poured)			A	Y										
Wall		Drywall and joint compound			A	Y		400			SF	V0001	None Detected	N.D.	None	



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Residence

Location: #7 : Apartment Managers Office

Floor: 1

Room #:

Area (sqft): 250

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling ¹		Ceiling Tiles (lay-in), 24x24 textured			C	Y						V0000	Non-Asbestos		None	
Duct		Not Insulated			C	N										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		250(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment		None Found														
Piping		Fibreglass			C	N										
Structure		Concrete (poured)			C	N										
Wall		Drywall and joint compound			A	Y		120			SF	S0001E	None Detected	N.D.	None	

1 - 06/17/19



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #8 : Corridor 2nd Floor

Floor: 2

Residence

Room #:

Area (sqft): 2000

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling ¹		Ceiling Tiles (lay-in), 24x24 textured			C	Y						V0000	Non-Asbestos		None	
Duct		Not Insulated			C	N										
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		200(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment		None Found														
Piping		Fibreglass			C	N										
Structure		Concrete (poured)			C	N										
Structure		Fireproofing (Fibrous)			C	N		2000			SF	S0003AB	None Detected	N.D.	None	
Wall		Drywall and joint compound			A	Y		120			SF	V0001	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										

1 - 06/17/19



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #9 : Amenity Room

Floor: 2

Residence

Area (sqft): 2500

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		2500			SF	V0001	None Detected	N.D.	None	
Ceiling		Texture Coat			C	Y		2000			SF	S0004ABC	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		2500(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		120			SF	V0001	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #10 : Unit 502

Floor: 2

Residence

Area (sqft): 600

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		600			SF	V0015	None Detected	N.D.	None	
Ceiling		Texture Coat			C	Y		600			SF	S0016ABC	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		600(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		900			SF	S0015ABC	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #11 : Unit 209

Floor: 2

Residence

Area (sqft): 600

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		600			SF	V0017	None Detected	N.D.	None	
Ceiling		Texture Coat			C	Y		600			SF	S0018ABC	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		600(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		900			SF	S0017ABC	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #12 : Office

Floor: 2

Residence

Area (sqft): 600

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		600			SF	V0001	None Detected	N.D.	None	
Ceiling		Texture Coat			C	Y		2000			SF	V0004	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		600(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		120			SF	V0001	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #13 : Garbage Rooms

Floor:

Residence

Room #:

Area (sqft): 350

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		350			SF	V0001	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		350(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping		Not Insulated			C	Y										
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		120			SF	V0001	None Detected	N.D.	None	

Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #14 : Corridor 3rd Floor

Floor: 3

Residence

Room #:

Area (sqft): 2000

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling ¹		Ceiling Tiles (lay-in), 24x24 textured			C	Y						V0000	Non-Asbestos		None	
Duct		Not Insulated			C	N										
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		200(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment		None Found														
Piping		Fibreglass			C	N										
Structure		Concrete (poured)			C	N										
Structure		Fireproofing (Fibrous)			C	N		2000			SF	S0003D	None Detected	N.D.	None	
Wall		Drywall and joint compound			A	Y		2500			SF	V0001	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										
Wall		Mortar, Thin-set			D	N		100(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

1 - 06/17/19



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #15 : Unit 302

Floor: 3

Residence

Area (sqft): 600

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		600			SF	V0005	None Detected	N.D.	None	
Ceiling		Texture Coat			C	Y		600			SF	S0006ABC	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		600(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		900			SF	S0005ABC	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #16 : Unit 307

Floor: 3

Residence

Area (sqft): 600

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		600			SF	V0007	None Detected	N.D.	None	
Ceiling		Texture Coat			C	Y		600			SF	S0008ABC	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		600(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		900			SF	S0007ABC	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #17 : Laundry Rooms

Floor: 1/2

Residence

Room #:

Area (sqft): 220

Survey Date: 2023-06-16

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		220			SF	V0001	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		220(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		120			SF	V0001	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										
Wall		Mortar, Thin-set			D	N		50(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #18 : Electrical Closets

Floor:

Residence

Room #:

Area (sqft): 60

Survey Date: 2023-06-16

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		None Found														
Duct		None Found														
Floor		Concrete (poured)			A	Y										
Mechanical Equipment		None Found														
Piping		None Found														
Structure		Concrete (poured)			C	Y										
Wall		Concrete (poured)			A	Y										

Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #19 : Corridor 4th Floor

Floor: 4

Residence

Room #:

Area (sqft): 2000

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling ¹		Ceiling Tiles (lay-in), 24x24 textured			C	Y						V0000	Non-Asbestos		None	
Duct		Not Insulated			C	N										
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		200(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment		None Found														
Piping		Fibreglass			C	N										
Structure		Concrete (poured)			C	N										
Structure		Fireproofing (Fibrous)			C	N		2000				S0003EFG	None Detected	N.D.	None	
Wall		Drywall and joint compound			A	Y		2500			SF	V0001	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										
Wall		Mortar, Thin-set			D	N		100(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

1 - 06/17/19



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #20 : Unit 405

Floor: 4

Residence

Room #:

Area (sqft): 600

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		600			SF	V0007	None Detected	N.D.	None	
Ceiling		Texture Coat			C	Y		600			SF	S0010ABC	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		600(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		900			SF	S0009ABC	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #21 : 5th Floor Corridor

Floor: 5

Residence

Room #:

Area (sqft): 2000

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling ¹		Ceiling Tiles (lay-in), 24x24 textured			C	Y						V0000	Non-Asbestos		None	
Duct		Not Insulated			C	N										
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		200(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment		None Found														
Piping		Fibreglass			C	N										
Structure		Concrete (poured)			C	N										
Structure		Fireproofing (Fibrous)			C	N		2000			SF	S0003C	None Detected	N.D.	None	
Wall		Drywall and joint compound			A	Y		2500			SF	S0001G	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										
Wall		Mortar, Thin-set			D	N		100(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

1 - 06/17/19



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #22 : Unit 501

Floor: 5

Residence

Area (sqft): 600

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		600			SF	V0007	None Detected	N.D.	None	
Ceiling		Texture Coat			C	Y		600			SF	S0012ABC	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		600(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		900			SF	S0011ABC	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #23 : 6th Floor Corridor

Floor: 6

Residence

Room #:

Area (sqft): 2000

Survey Date: 2023-05-31

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling ¹		Ceiling Tiles (lay-in), 24x24 textured			C	Y						V0000	Non-Asbestos		None	
Duct		Not Insulated			C	N										
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		200(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment		None Found														
Piping		Fibreglass			C	N										
Structure		Concrete (poured)			C	N										
Structure		Fireproofing (Fibrous)			C	N		2000			SF	V0003	None Detected	N.D.	None	
Wall		Drywall and joint compound			A	Y		2500			SF	S0001F	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										
Wall		Mortar, Thin-set			D	N		100(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

1 - 06/17/19



ALL DATA REPORT



Client: Region Of Halton

Site: 540 Plains Road East, Burlington, ON

Building Name: Aldershot Village Seniors

Location: #24 : Unit 607

Floor: 6

Residence

Area (sqft): 600

Survey Date: 2023-05-31

Room #:

Last Re-Assessment: 0000-00-00

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Drywall and joint compound			C	Y		600			SF	V0013	None Detected	N.D.	None	
Ceiling		Texture Coat			C	Y		600			SF	S0014ABC	None Detected	N.D.	None	
Duct	Not Accessible															
Floor		Concrete (poured)		Carpet	A	Y										
Floor		Ceramic Tiles			A	Y										
Floor		Mortar, Thin-set			D	N		600(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF
Mechanical Equipment	Not Accessible															
Piping	Not Accessible															
Structure	Not Accessible															
Wall		Drywall and joint compound			A	Y		900			SF	S0013ABC	None Detected	N.D.	None	
Wall		Ceramic Tiles			A	Y										
Wall		Mortar, Thin-set			D	N		200(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

ALL DATA REPORT

Legend:

Sample number		Units		Other	
S####	Asbestos sample collected	SF	Square feet	A	Access
V####	Material visually similar to numbered sample collected	LF	Linear feet	V	Visible
V0000	Known non-asbestos material	EA	Each	AP	Air Plenum
V9000	Visually identified as an asbestos material	%	Percentage	F	Friable material
V9500	Material is presumed to be an asbestos material			NF	Non Friable material
				PF	Potentially Friable material

Access		Condition	
A	Accessible to all building occupants	Good	No visible damage or deterioration
B	Accessible to maintenance and operations staff without a ladder	Fair	Minor, repairable damage, cracking, delamination or deterioration
C	Accessible to maintenance and operations staff with a ladder. Also rarely entered, locked areas	Poor	Irreparable damage or deterioration with exposed and missing material
D	Not normally accessible		

Visible		Air Plenum	
Y	The material is visible when standing on the floor of the room, without the removal or opening of other building components (e.g. ceiling tiles or access panels).	Yes or No	The material is in a return air plenum or in a direct airstream or there is evidence of air erosion (e.g. duct for heating or cooling blowing directly on or across an ACM). This field is only completed where Air Plenum consideration is required by regulation.
N	The material is not visible to view when standing on the floor of the room and requires the removal of a building component (e.g. ceilings tiles or access panels) to view and access. Includes rarely entered crawlspaces, attic spaces, etc. Observations will be limited to the extent visible from the access points.		

Colour Coding	
	The material is known to contain regulated concentrations of asbestos; either by analytical results or visible identification (use of the V9000 code).
	The material is presumed to contain asbestos; based on visual appearances; typically a material known to historically contain asbestos; however, not sampled due to limited access or the destructive nature of the sampling.

Action					
(1)	Clean up of ACM Debris	(2)	Precautions for Access Which may Disturb ACM Debris	(3)	ACM removal
(4)	Precautions for Work Which may Disturb ACM in Poor Condition	(5)	Proactive ACM removal (Minimum repair required for fair condition)	(6)	ACM repair
(7)	Management program and surveillance				