



THE REGIONAL MUNICIPALITY OF HALTON

REQUEST FOR TENDERS

FOR

**BUILDING SYSTEM UPGRADES -
HVAC, LED LIGHTING, NURSING CALL, AND
KITCHEN FIRE SUPPRESSION HOOD
AT 2387 INDUSTRIAL ST, BURLINGTON, ON**

TENDER # T-734-26

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

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



Supplementary Instructions to Bidders

Contract No. T-734-26 Building Systems Upgrade – HVAC, LED Lighting, Nursing Call, and Kitchen Fire Suppression Hood at 2387 Industrial St, Burlington, ON

1. Key Bid Dates:

a. **Bid Issue Date:** Thursday, April 16, 2026

b. **Pre-Bid Meeting and Site Visit:**

Non-Mandatory Site Meeting: Friday, April 24, 2026, at 10:00 am ET

The non-mandatory site meeting will be held at Bethany Residence, 2387 Industrial St, Burlington, ON L7P 3A1.

Attendees will be met at the Front entrance. 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:** Wednesday, May 6, 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:**

Thursday, May 14, 2026, at 2:00 pm ET

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

Please note, should the Bidder complete any obligations, including 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 fourteen (14) days from the receipt of the Notice of Award Letter.
- b. **Ready-for-Takeover:** The successful Bidder shall achieve Ready-for-Takeover by thirty-two (32) weeks from Notice of Award.
- c. **Completion:** The successful Bidder shall achieve Completion by four (4) weeks from Ready for Takeover.

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 [N/A]

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

1. 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*.
2. 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 Tender:

Bid Documents	No. of Pages
Cover Page	1
Supplementary Instructions to Bidders	4
Instructions to Bidders	50
CCDC 2 – 2020 Stipulated Price Contract	30
Supplementary Conditions CCDC 2 - 2020	64
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
Technical Specifications (incl. cover page)	550
Attachment A - Drawings Set: Electrical and Mechanical (incl. cover page)	32
Attachment B – Hazardous Building Materials Assessment (Management) July 12, 2023	46
Total Pages (As Issued)	786
All other documents issued with this Request for Tenders that are not listed above	



INSTRUCTIONS TO BIDDERS

July 2025

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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. GREEN PROCUREMENT

Not Applicable

28. ONTARIANS REGULATION 191/11 – INTEGRATED ACCESSIBILITY STANDARDS

- 28.1 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.
- 28.2 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.

29. NON-RESIDENT WITHHOLDING TAX

- 29.1 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.

30. FREEDOM OF INFORMATION

- 30.1 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

Principal

Signature

ATTORNEY IN FACT

(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

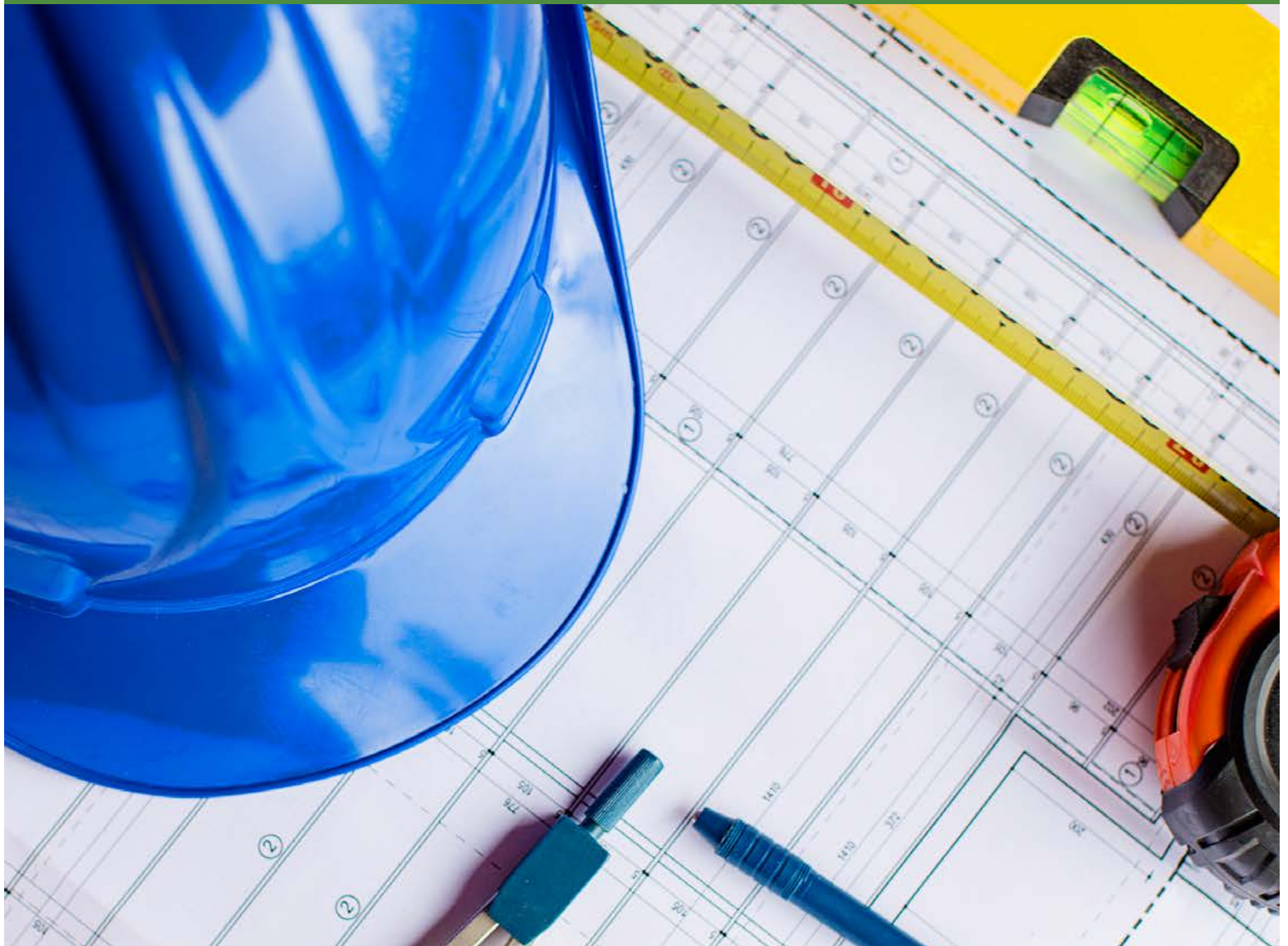
- N.B.** Where legal jurisdiction, local practice or Owner or Contractor requirement calls for:
- (a) proof of authority to execute this document, attach such proof of authority in the form of a certified copy of a resolution naming the representative(s) authorized to sign the Agreement for and on behalf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



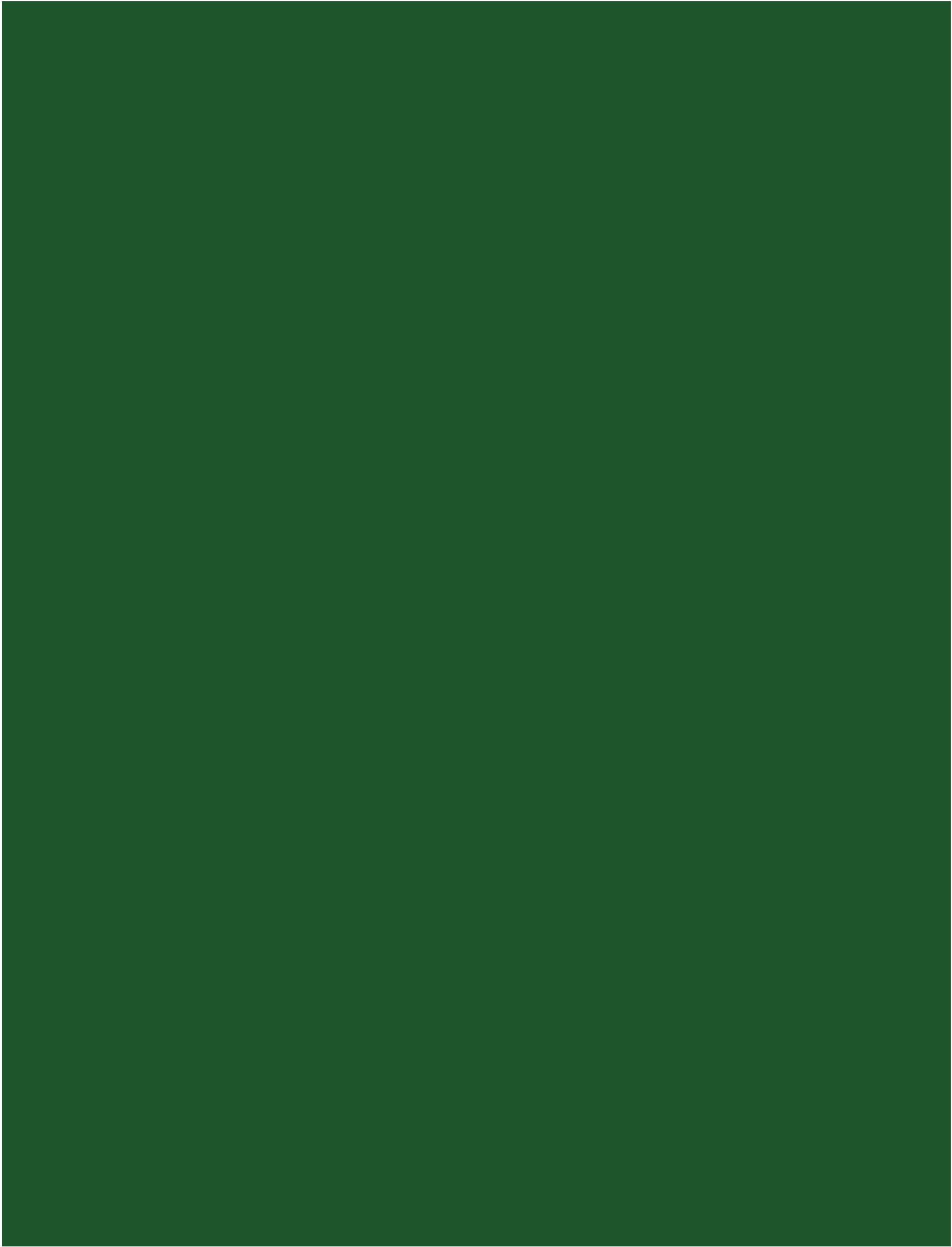
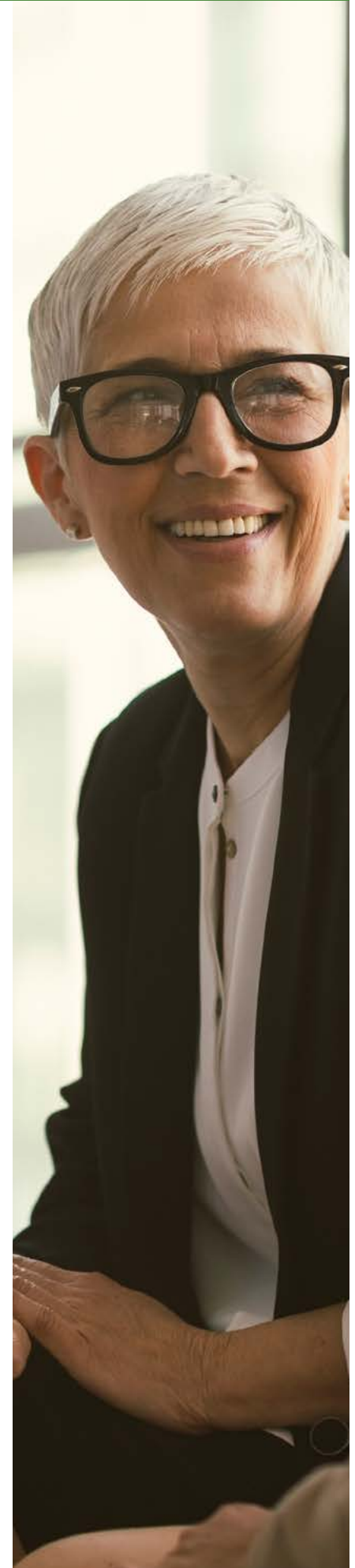
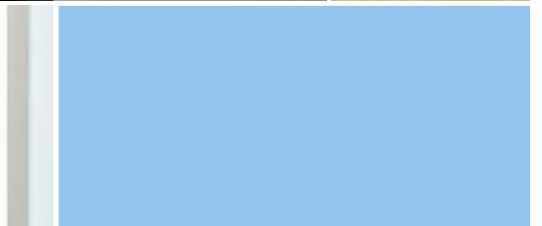
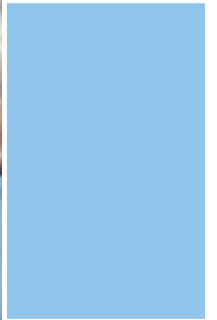
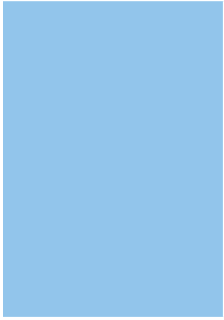
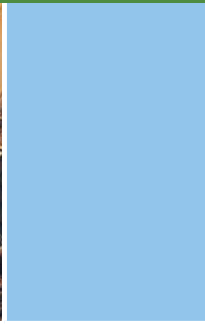
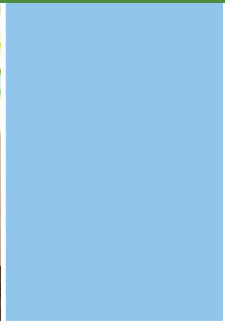


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Introduction and Purpose

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.

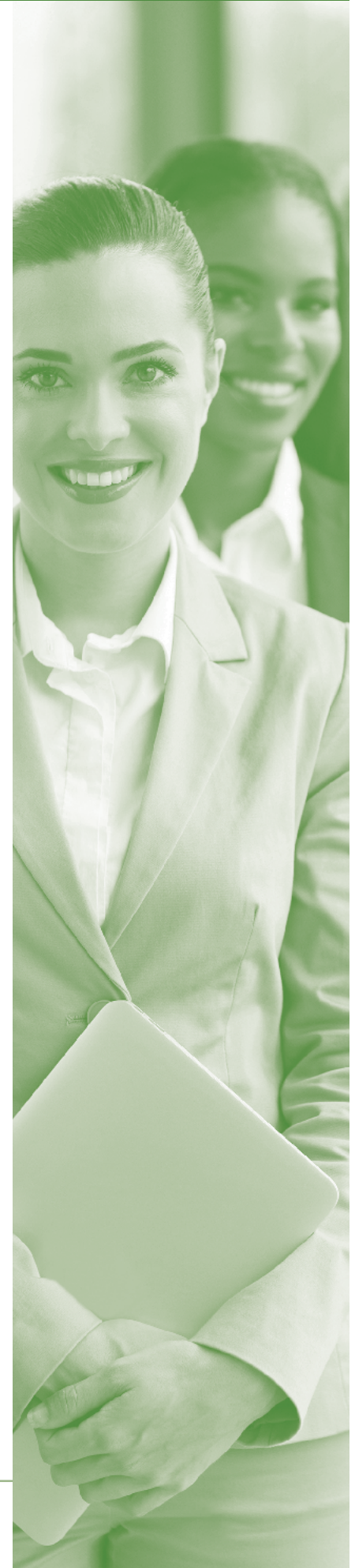
Under no circumstances should a Vendor solicit gifts, hospitality and/or other benefits or transfers of economic value to Region staff. The same is expected of the Region staff—not to solicit gifts or other benefits from Vendors.

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.

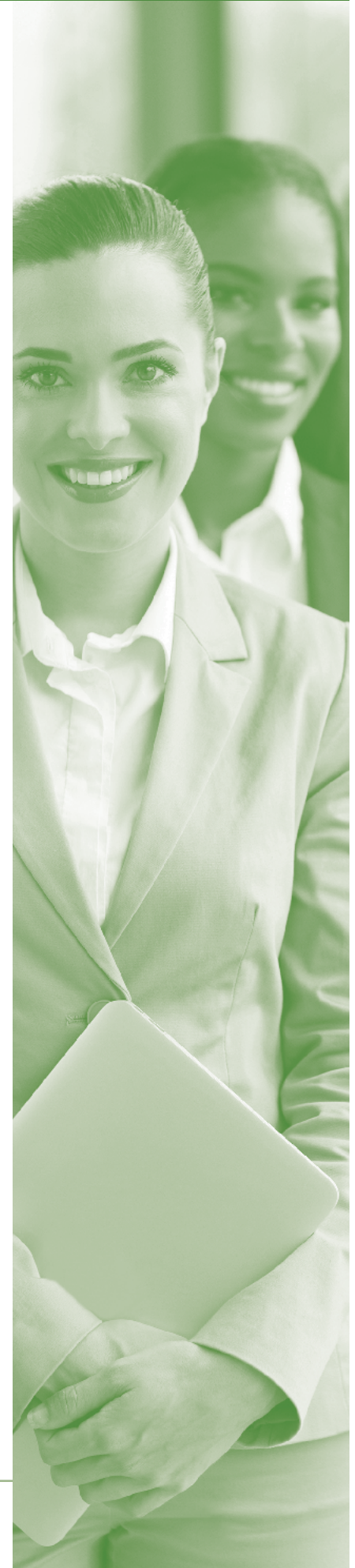
Types of bribery can include, but are not limited to:

- 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 close-up photograph of a man with short dark hair and a light beard, wearing a blue button-down shirt. He is looking down at a white tablet computer he is holding in his hands. The background is blurred.

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

T-734-26 Building Systems Upgrade – HVAC, LED, Nursing Call and Kitchen Fire Suppression Hood at 2387 Industrial St, 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

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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**

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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>	Thirty-two (32) weeks from the date of commencement of the Work stipulated in the Notice of Award.
SC-1	Paragraph 1.3 of Article A-1	<i>Completion Date</i>	Four (4) weeks from date to achieve Ready-For-Takeover.
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	\$500 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>	greeshma.gopinath@halton.ca MKahlon@probuildengineering.ca

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																																																																
Contract Title Contract Number Purchase Order Number Payment Certificate No. Work Completed From To	Insert title Insert number Insert number Insert number Insert period start date Insert period end date																																																																
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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)																																																																
<table border="0" style="width: 100%;"> <tr> <td style="width: 40%;"></td> <td style="text-align: center;"><u>To Date</u></td> <td style="text-align: center;"><u>Previous</u></td> <td style="text-align: center;"><u>Current</u></td> </tr> <tr> <td>Value of Work Performed (excl. Change Orders)</td> <td style="text-align: right;">\$ -</td> <td style="text-align: right;">\$ -</td> <td style="text-align: right;">\$ -</td> </tr> <tr> <td>Value of Change Orders Performed</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Gross Payment</td> <td style="text-align: right;">\$ -</td> <td style="text-align: right;">\$ -</td> <td style="text-align: right;">\$ -</td> </tr> <tr> <td>Less Statutory Holdback (10%)</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Release of Statutory Holdback (10%)</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Less Finishing Holdback (10%)</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Release of Finishing Holdback (10%)</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Less Warranty Security</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Release of Warranty Security</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Less Other Retainers</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Release of Other Retainers</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Total Net Payment</td> <td style="text-align: right;">\$ -</td> <td style="text-align: right;">\$ -</td> <td style="text-align: right;">\$ -</td> </tr> <tr> <td>HST (13%)</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Less Liquidated Damages</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> <td style="text-align: right;">-</td> </tr> <tr> <td>Total Recommended Payment</td> <td></td> <td></td> <td style="text-align: right; border-top: 1px solid black; border-bottom: 3px double black;">\$ -</td> </tr> </table>		<u>To Date</u>	<u>Previous</u>	<u>Current</u>	Value of Work Performed (excl. Change Orders)	\$ -	\$ -	\$ -	Value of Change Orders Performed	-	-	-	Gross Payment	\$ -	\$ -	\$ -	Less Statutory Holdback (10%)	-	-	-	Release of Statutory Holdback (10%)	-	-	-	Less Finishing Holdback (10%)	-	-	-	Release of Finishing Holdback (10%)	-	-	-	Less Warranty Security	-	-	-	Release of Warranty Security	-	-	-	Less Other Retainers	-	-	-	Release of Other Retainers	-	-	-	Total Net Payment	\$ -	\$ -	\$ -	HST (13%)	-	-	-	Less Liquidated Damages	-	-	-	Total Recommended Payment			\$ -	
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Less Liquidated Damages	-	-	-																																																														
Total Recommended Payment			\$ -																																																														
Attachments submitted with this Invoice ☐	☐ Statutory Declaration ☐ Progress and Look Ahead Work Schedules per Contract ☐ WSIB ☐ Certificate of Insurance ☐ Tender Price Breakdown/Schedule of Values ☐ Halton Region's Construction Health & Safety for Consultants and Constructors training module ☐ Completion Certificate ☐ If applicable, CPC-Accredited OHSM3 Certification ☐ Other _____																																																																
Approved by Contractor																																																																	
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*.

TECHNICAL SPECIFICATIONS

DIVISION 01 – GENERAL REQUIREMENTS

011100	SUMMARY OF WORK
011115	USE OF SITE
011410	COORDINATION
012310	ALTERNATES
013100	CONSTRUCTION SCHEDULE
013113	PROJECT MANAGEMENT AND COORDINATION
013119	PROJECT MEETINGS
013200	CONSTRUCTION PROGRESS DOCUMENTATION
013300	SUBMITTAL PROCEDURES
014100	REGULATORY REQUIREMENTS
014300	QUALITY ASSURANCE
015900	PROTECTION OF WORK AND PROPERTY
016100	COMMON PRODUCT REQUIREMENTS
017300	EXECUTION
017400	CLEANING
017419	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
017500	WARRANTY
017800	CLOSEOUT SUBMITTALS
017900.13	DEMONSTRATION AND TRAINING FOR BUILDING COM.
019113	GENERAL COMMISSIONING (CX) REQUIREMENTS

DIVISION 22 – PLUMBING

220500	PLUMBING GENERAL
220505	SELECTIVE DEMOLITION FOR PLUMBING
220515	PLUMBING SPECIALTIES AND ACCESSORIES
220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
220553	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
220593.13	TESTING AND BALANCING SYSTEM
220600	DOMESTIC WATER SUPPLY PIPING - COPPER
220716	PLUMBING EQUIPMENT INSULATION

DIVISION 23 – HVAC

230500	COMMON WORK RESULTS FOR HVAC
230501	USE OF HVAC SYSTEM DURING CONSTRUCTION
230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
230515	COMMON INSTALLATION REQ. FOR HVAC PIPEWORK
230519	METERS AND GAUGES FOR HVAC PIPING
230519.13	THERMOMETERS AND PRESSURE GAUGES
230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIP.
230553	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
230553.01	MECHANICAL IDENTIFICATION

230593	TESTING ADJUSTING AND BALANCING
230594	PRESSURE TESTING OF DUCTED AIR SYSTEMS
230700	DUCT ACCESSORIES
230713	DUCT INSULATION
230719	HVAC PIPING INSULATION
230800	COMMISSIONING OF HVAC
230801	PERFORMANCE VERIFICATION MECHANICAL PIPING SYSTEMS
230802	CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS
231123	FACILITY NATURAL GAS PIPING
232113	PIPING VALVES AND FITTINGS
232113.02	HYDRONIC SYSTEMS - STEEL
232114	HYDRONIC SPECIALTIES
232200	MOTORS, STARTERS AND WIRING
232500	HVAC WATER TREATMENT
233113.01	METAL DUCTS – LOW PRESSURE TO 500PA
233300	AIR DUCT ACCESSORIES
233315	DAMPERS - OPERATING
233316	DAMPERS – FIRE AND SMOKE
233353	DUCT LINERS
233360	DUCT ACCESSORIES
233700	AIR OUTLETS AND INLETS
233713	DIFFUSERS, REGISTERS AND GRILLES
233720	LOUVRES, INTAKES AND VENTS
233813	COMMERCIAL KITCHEN HOODS
235100	BREECHING, CHIMNEYS AND STACKS
238239	UNIT HEATERS – STEAM/HYDRONIC

DIVISION 26 – ELECTRICAL

260500	COMMON WORK RESULTS - ELECTRICAL
260505	SELECTIVE DEMOLITION FOR ELECTRICAL
260514	POWER CABLE AND OVERHEAD CONNECTORS
260520	WIRE AND BOX CONNECTORS 0-1000V
260521	WIRES AND CABLES (0-1000V)
260522	CONNECTORS AND TERMINATIONS.
260527	GROUNDING - PRIMARY
260528	GROUNDING – SECONDARY.
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
260531	SPLITTERS, JUNCTION, PULL BOXES AND CABINETS.
260532	OUTLET BOXES, CONDUIT BOXES AND FITTINGS
260533.01	SURFACE AND LIGHTING FIXTURE RACEWAYS
260534	CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS
260536	CABLE TRAYS FOR ELECTRICAL SYSTEMS
260537	WIREWAYS AND AUXILIARY GUTTERS
260543.01	INSTALLATION OF CABLES IN TRENCHES AND IN DUCTS
260573	POWER SYSTEM STUDIES
260800	COMMISSIONING OF ELECTRICAL SYTEMS
260923.01	METERING AND SWITCHBOARD INSTRUMENTS

260923.02	LIGHTING CONTROL DEVICES - PHOTOELECTRIC
260923.03	LIGHTING CONTROL DEVICES – INCANDESCENT DIMMING
260923.04	LIGHTING CONTROL DEVICES – FLUORESCENT DIMMING
260924	LIGHTING CONTROL DEVICES – LOW VOLTAGE
261301	ISOLATING SWITCHES TO 15KV
262300	LOW VOLTAGE SWITCHGEAR
262401	SERVICE EQUIPMENT
262402	SERVICE ENTRANCE BOARD
262405	SERVICE ENTRANCE TVSS PROTECTION
262416.01	PANELBOARDS – BREAKER TYPE
262416.02	PANELBOARDS – SWITCH AND FUSE TYPE
262419	MOTOR CONTROL CENTERS
262710	MODULAR WIRING SYSTEM
262719	MULTI-OUTLET ASSEMBLIES
262723	INDOOR SERVICE POLES
262726	WIRING DEVICES
262813.01	FUSES – LOW VOLTAGE
262813.02	OUTDOOR LOAD BREAK SWITCHES AND FUSES
262816.01	AIR CIRCUIT BREAKERS
262816.02	MOULDED CASE CIRCUIT BREAKERS
262818	GROUND FAULT EQUIPMENT PROTECTION
262820	GROUND FAULT CIRCUIT INTERRUPTERS – CLASS “A”
262823	DISCONNECT SWITCHES – FUSED AND NON-FUSED
262901	CONTRACTORS
262903	CONTROL DEVICES
263353	STATIC UNINTERRUPTIBLE POWER SUPPLY
264100.01	PRIMARY LIGHTING ARRESTERS
264100.02	SECONDARY LIGHTING ARRESTERS
264200	CATHODIC PROTECTION
265000	LIGHTING
265213.13	EMERGENCY LIGHTING
265213.16	EXIT SIGNS
265313	PHOTOLUMINESCENT EXIT SIGNS
269000	WIRING OF EQUIPMENT SUPPLIED BY OTHERS

END OF SECTION

1.0 GENERAL**1.1 WORK COVERED BY CONTRACT DOCUMENTS****.1 LED upgrades:**

- .1 Replacement of all interior and exterior lighting in buildings with LED light as mentioned in the Specifications and Drawing set.
- .2 Replacement and upgrade of all Exit lighting signs and emergency lights powered by battery backup in all buildings as per the latest Building Code standards.
- .3 In addition to the replacement of existing light fixtures with new, provide additional light fixtures as shown on Drawing Sets. Extend wiring from adjacent fixtures where possible and / or extend wiring from the electrical panel and or junction box to suit new additional light fixtures.
- .4 Extend new wiring in conduits to serve new light fixtures on exterior walls.
- .5 Coordinate exact location of light fixtures with facility staff, coordinate all new fixture location with facility before commencing work.
- .6 Carry cost to inspect all existing power to existing fixtures and carry cost to replace wiring were required as part of Base Bid price.
- .7 Replace all emergency exit signs with new green running man signs. New installation to match existing (wall/ceiling mounts).
- .8 Replace all existing emergency light fixtures with new.
- .9 Contractor to paint and patch area around existing/new light fixture to match existing, where the fixture sizes differ between new and existing.

.2 Nurse Call Bell:

- .1 Upgrades to the existing nurse call system in its entirety with new Helpcall system. The nurse call stations are to be wall-mounted model CTC-1039 connected to new landline service, PSTN telecare alarm supported by cable telephone system.
- .2 Nurse call unit to have communication protocol with monitoring center with two-way voice communication, recordable voice messages, voice reporting, hands free call answering, permanent and mobile stations. The nurse call units with 12v/1A power adaptor, backup battery (7.2V 600mAH Ni-MH rechargeable battery, battery life 21 hrs.
- .3 Install new nurse call units in place of existing, and install new units where not previously installed.
- .4 Provide 1 data junction per building (total 5 buildings), provide Cat5e cable from 2-way audio unit in rooms to data junction box. Provide Cat6 cable from each base station location to the nearest junction box for

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- cordless phone base stations. Provide Cat6 from each phone location to nearest junction box for Desk Sets.
 - .5 Provide new wiring and conduits to all nurse stations throughout the 4 buildings. Refer to plan drawings for locations of all nurse call units. New wiring is to be in conduit and installed above T-bar ceiling and below drywall ceilings. Extend wiring in conduit on wall to nurse call unit.
 - .6 All cable runs are to be home runs to data junction box in respective buildings. Provide uplink cables to connect each data junctions to other junction boxes.
 - .7 Provide pull cord nurse call units in the washroom as shown on plan drawings. The pull cord units are to be wired to the nearest 2-way communication unit (model CTC-1039). The pull cord unit is to be Helpcall model CTC 1039, battery operated.
- .3 Gas Fired Domestic and Heating Boiler and Pumps (Main Building, 2387 Industrial St, Burlington)
- .1 Remove and replace two existing domestic hot water boilers with new high-efficiency units in the basement Mechanical room of Main Building.
 - .2 Reconnect gas piping, plumbing piping, electrical power and flue venting to new boilers.
 - .3 Remove and replace the existing single heating boilers with two new high efficiency boilers in basement Mech room of Main Building. Reconnect gas piping, plumbing piping, electrical power and flue venting to new boilers. Provide a low-loss header and associated pumps.
 - .4 Remove and replace the existing heating loop pump with new, reconnect to existing piping and power.
 - .5 Clean and flush existing and new piping system before putting the system back into service. Provide cleaning to report for review.
 - .6 Test, adjust and balance the new hydronic system as per specifications.
- .4 In-Floor Heating Boiler (1119 Homewood Dr):
- .1 Remove and replace existing gas-fired hot water heating boilers for the in-floor heating system located in Basement Mechanical room of 1119 Homewood Dr.
 - .2 Remove and replace the existing single heating boiler with new high efficiency boilers. Reconnect gas piping, plumbing piping, electrical power and flue venting to new boilers.
 - .3 Clean and flush existing and new piping system before putting the system back into service. Provide cleaning to report for review.
 - .4 Test, adjust and balance the new hydronic system as per specifications.

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- .5 Unit Heater (Basement of Main Building- 2387 Industrial St, Burlington):
 - .1 Remove and replace existing hot water unit heaters with new in Basement of Main Building. Reconnect existing piping and power to new unit heater. Connect existing thermostat to new unit heater.
 - .2 Startup the unit and provide the testing report.
 - .6 Domestic Hot Water Heater (Basement Laundry Room 1123 Homewood Dr):
 - .1 Remove and Replace the DHW tank with new high-efficiency water heater (tank type) located in 1123 Homewood Dr. in the basement level Laundry room.
 - .2 New hot water tank is to be gas-fired with power vent. Extend new flue/combustion air pipe out through exterior wall. Remove existing flue venting. Reconnect existing gas piping, plumbing piping and electric power to new tank.
 - .7 Replacement of Ductwork (Main Building- - 2387 Industrial St, Burlington):
 - .1 Remove and replace existing ductwork serving existing furnace unit in the basement level of the Main Building. Remove and replace all existing ductwork up and downstream of the furnace. Replace existing incoming fresh air grille with new ones of same size.
 - .2 Air balance the air flow at supply and return air grilles.
 - .8 Kitchen Fire Suppression Hood (Servery Kitchen in Main Building- - 2387 Industrial St, Burlington):
 - .1 Remove & replace the existing fire suppression system in existing hood with new, including new tank. Existing hood and kitchen equipment is to remain. Refer to hood suppression system drawings for system details.
 - .9 Miscellaneous:
 - .1 It is the Contractor's responsibility to provide all labour, material, equipment and supervision to complete the repairs outlined in this specification taking into account all site conditions, noise restriction, work area restrictions, protection requirements, accessibility restrictions, etc. No extras will be entertained for inconveniences after the award of this Contract.
 - .2 Final cleaning of structure, fixtures, piping etc., and the disposal of all waste products and /or debris generated by the construction activity as well as any material present in the work area before the commencement of the work. The areas requiring cleaning shall consist of all areas affected by the Work.
 - .3 Update existing single line diagram to reflect new installations.

- .4 Upon Notice of Award general contractor to submit cost breakdown and schedule for work within 4 weeks.
- .5 Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions, manufacturer's warranty and O&M manual requirements.
- .6 Prior to commencement of work submit work plan, detailing sequence of work, and schedule for approval by Consultant and Region's Representative.
- .7 Provide all new valves and pipe fittings as required to make new system fully operational.

1.2 CONTRACTOR USE OF PREMISES

- .1 Coordinate use of premises under direction of Region's representative.
- .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .3 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .4 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by consultant.

1.3 REGION'S REPRESENTATIVE OCCUPANCY

- .1 The residents will occupy premises during entire construction period for execution of normal operations.
- .2 Cooperate with Region's representative in scheduling operations to minimize conflict and to facilitate the Regions usage.

1.4 RELATED WORK

- .1 The following specification sections are referenced to indicate work responsibilities as specified and carried in other sections.
 - .1 Section 22 05 00 – Plumbing General.
 - .2 Section 23 05 00 – Common Work Results for HVAC.
 - .3 Section 26 05 00 – Common Work Results – Electrical.

1.5 ON-SITE DOCUMENTS

- .1 Maintain at job site documents as indicated in Section 01 31 13 – Project Management and Coordination.

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Building Systems Upgrade – HVAC, LED and Nursing Call, 2387 Industrial St, Burlington

Section 011100
Summary of Work

1.6 CONTRACT DOCUMENTS

- .1 Legends and schedules in the Issued for Tender Drawings take precedence over the Technical Specifications with respect to products and materials identified.

2.0 PRODUCTS (NOT APPLICABLE)**3.0 EXECUTION (NOT APPLICABLE)****END OF SECTION**

1.0 GENERAL

1.1 CONTRACTOR'S USE OF SITE

- .1 The building is to remain operational throughout the course of the Work. The Contractor shall have access to the designated work areas only, unless otherwise stipulated by the Region's Representative during the Work. Access to other areas of building is not permitted unless supervised by Region's Representative. The working hours are 8:00am – 4:00pm Monday – Friday. Work over the weekends or after hours will require written permission from the Region's Representative.
- 2 The Contractor shall co-ordinate his work schedule with the Region's Representative to minimize disruptions of the site. No work shall be performed until approved by the Region's Representative.
- 3 It is the Contractor's responsibility to ensure the building always remains operational and to perform work as required to ensure that a minimum of one (1) exit and one (1) entrance is always available to the patrons.
- 4 Provide signage of professional quality, barriers and hoarding necessary to protect the public from the Contractor's operations and route traffic through the work areas. Signage must be provided at each entrance indicating repairs are being performed at the site. These signage requirements are in addition to any standard signs required to control and/or reroute traffic through the site.
- 5 The use of all power equipment is to be in accordance with all local by-laws and ordinances.
- 6 Do not unreasonably encumber site with materials or equipment.
- 7 Do not close or obstruct or store materials in roadways, sidewalks, or passageways without prior approval from the Region's Representative/Property Manager. Do not interfere with safe passage to and from the building and adjacent public sidewalks and roads.
- 8 Move stored products or equipment which interferes with operations of the building, Region's Representative.
- 9 General Contractor to obtain and pay for all necessary approvals to locate equipment or materials on city property.
- .10 Protect all existing light standards, walls, plants, finishes, windows, doors, etc where required.
- .11 Protect all utilities, gas mains, electrical conduit, etc. that must remain in service throughout the construction period.

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- .12 During transportation of materials or equipment through occupied areas, ensure vehicles are protected from damage. All damage to vehicles will be repaired at Contractor's expense.
 - .13 The Contractor shall make allowance in their price to cover all costs of temporary removal and replacement and/or relocation of existing electrical wiring and mechanical hardware required for completion of the work.
 - .14 Disposal bins, supply trucks, etc. are to be located on site as per the designated location of Region's Representative.
 - .15 Maintain free access routes for ambulance, fire emergency vehicles, garbage trucks, etc.

1.2 EFFECT ON BUILDING OPERATIONS

- 1 The Contractor shall schedule its operation to minimize the interruption of the normal use of the site and building and to comply with laws, by-laws, ordinances, rules and regulations relating to the Work.
- 2 The Contractor shall be responsible for arranging for the location of all existing utilities prior to construction and protection of the same during construction.

2.0 PRODUCTS

Not applicable

3.0 EXECUTION

Not applicable

END OF SECTION

1.0 GENERAL

1.1 PROJECT CO-ORDINATION

- .1 The Contractor is responsible for co-ordination of all sub-trades. Lines of demarcation between Contractors and Trades or trade and trade are solely the responsibility of the Contractor. The Consultant assumes no responsibility for the division of the work or for any jurisdictional involvements because of such division.
- .2 Contractor is responsible for co-ordination with the Region's Representative of all on-site activity as it affects the operation of the building.

1.2 NOTIFICATION FOR INSPECTION

- .1 The Contractor is to notify the Consultant at least 24 hours in advance for inspections. No work shall be covered or concealed until reviewed by the Consultant unless Contractor is informed that an inspection will not be performed. Such review does not absolve the Contractor from his responsibility to perform his work in accordance with the Contract Documents.
- .2 The Consultant shall notify the designated inspection company for material sampling and testing.
- .3 The Contractor shall promptly provide the Consultant with safe access to any part of the Work requiring inspection.
- .4 The Region's Representative may be present during inspections carried out by the Consultant at the Region Representative's discretion.

1.3 SUPERINTENDENCE

- .1 The Contractor is to provide a full time Superintendent who is to be on-site on a continuous basis during the execution of the work and shall not be changed without Consultant's consent. Superintendent shall have as a minimum, a pager at all times during Working hours to allow for communication with Consultant, or Region's Representative.
- .2 Superintendence shall be deemed not satisfactory and changes or additions to the superintendence may be demanded when control, organization or co-ordination of the Work is not satisfactory, or, the quality of the Work does not meet the requirements of the Contract Documents, or directions given in accordance with the Contract Documents are not followed, or progress is behind schedule.

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Building Systems Upgrade – HVAC, LED and Nursing Call, 2387 Industrial St, Burlington

Section 011410

Coordination

2.0 PRODUCTS

Not applicable

3.0 EXECUTION

Not applicable

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 11 00 Summary of Work.

1.2 SUBSTITUTION OF MATERIALS PRIOR TO BID CLOSING

- .1 Where products or systems have been specified by trade name no substitution will be allowed except where alternates have been approved by the Consultant prior to bid closing. This request must be submitted to the Region and approved prior to Bid closure.
- .2 Where a specified product or system is not available at the time of tender, the Contractor must inform the Consultant in writing so that he may advise all bidders of proposed changes. If the Contractor fails to do so, the Consultant will choose a substitute item suitable for the application at the time of construction.

1.3 REQUEST FOR APPROVAL OF ALTERNATIVES

- .1 Contractors and suppliers of products or systems which have not been specified may apply for approval of their product/system as “alternative”.
- .2 Requests for approval must reach the Consultant and the Region’s Representative before tender closing. The Consultant shall advise applicants of the status of their request three (3) working days prior to the tender closing.
- .3 Request for approval shall include:
 - .1 Project name and number
 - .2 Specification section in which the product/system is specified.
 - .3 Description of proposed substitute including:
 - .1 manufacturer’s material specifications
 - .2 manufacturer’s preparation and application requirements
 - .3 manufacturer’s warranties.
- .4 Installation history of proposed substitute including:

- .1 projects and locations
 - .2 approximate value of contract
 - .3 approximate size of projects
 - .4 number of years in use
 - .5 type of use
 - .6 name of Region's Representative and Consultant involved.
 - .7 additional information as specified in the applicable division.
- .5 When submitting alternatives to materials or equipment specified, Bidder shall include in their Bid any changes in the Work required to accommodate such alternatives. A later claim for addition to the Contract Price because of changes in the Work necessitated using alternatives will not be considered.
- .6 All requests shall be submitted digitally to the Region.

1.4 APPROVAL OF ALTERNATIVES

- .1 The Consultant reserves the right to reject any or all requests for approval.
- .2 An addendum will be issued prior to bid closing if an alternative is approved. No alternative materials or equipment will be considered after bid closing.
- .3 Product/systems which have been approved as alternatives may be substituted for specified product/systems at the time of tender.
- .4 Should any proposed substitution be accepted either in part or in whole, the Contractor shall assume full responsibility and costs when substitution affects other work on project and pay for drawing changes required because of substitution.
- .5 All credits arising from approval of substitutions will be credited to Contract in such amounts as may be determined by the Consultant and Contract Price will be adjusted accordingly.
- .6 No substitutions will be permitted without prior written approval of the consultant.

2.0 PRODUCTS

Not applicable

3.0 EXECUTION

Not applicable

END OF SECTION

1. GENERAL**1.1 SECTION INCLUDES**

- .1 Schedule, form, content
- .2 Staged construction
- .3 Scheduled revisions
- .4 Critical path scheduling

1.2 SCHEDULES REQUIRED

- .1 Submit the following schedules:
 - .1 Construction Progress Schedule
 - .2 Submittal Schedule for Shop Drawings and Product Data
 - .3 Product Delivery Schedule

1.3 FORMAT

- .1 Prepare schedule in the form of a horizontal bar chart.
- .2 Provide a separate bar for each trade or operation.
- .3 Provide horizontal time scale identifying the first work day of each week.
- .4 Format for listings: The chronological order of the start of each item of work.
- .5 Identification of listings: By systems description.

1.4 SUBMISSION

- .1 Submit initial schedules within 4 weeks of Notice of Award.
- .2 Submit copies to be retained by the Region's Representative and Consultant.
- .3 Consultant will review schedule and return review copy within 3 days after receipt.
- .4 Resubmit finalized schedule within seven (7) days after return of review copy.
- .5 Submit revised progress schedule with each application for payment.

- .6 Distribute copies of the revised schedule to:
 - .1 Region's Representative / Consultant
 - .2 Subcontractors.
 - .3 Other concerned parties.

1.5 CONSTRUCTION PROGRESS SCHEDULE

- .1 Include the complete sequence of construction activities.
- .2 Include the dates for the commencement and completion of each major elements of construction including the following.
 - .1 Site clearing.
 - .2 Site utilities.
 - .3 Special Subcontractor work.
 - .4 Equipment Installations.
 - .5 Finishes.
- .3 Show projected percentage of completion of each item as of the first day of the month.
- .4 Indicate progress of each activity to date of submission schedule.
- .5 Show changes occurring since previous submission of schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.
 - .4 Other identifiable changes.
- .6 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and the impact on the schedule.
 - .2 Corrective action recommended and its effect.

- .3 The effect of changes on schedules of other prime contractors.

1.6 SUBMITTALS SCHEDULE

- .1 Include schedule for submitting shop drawings and product data.
- .2 Indicate dates for submitting, review time, resubmission time, float time, last date for meeting fabrication schedule.
- .3 Include dates when reviewed submittals will be required from the Consultant.

2. PRODUCTS

Not applicable

3. EXECUTION

Not applicable

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Coordination work with other contractors and subcontractors under administration of Region's Representative.
- .2 Scheduled project meetings.

1.2 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 DESCRIPTION

- .1 Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other contractors and subcontractors under instructions of Region's Representative.

1.4 PROJECT MEETINGS

- .1 Project meetings to be held at times and locations as determined by Region's Representative. Region's Representative will arrange project meetings and record and distribute minutes.

1.5 CONSTRUCTION ORGANIZATION AND START-UP

- .1 Within ten (10) working days after Notice of Award attend the kickoff meeting to discuss administrative procedures and responsibilities.
- .2 Proceed to submit the following:
 - .1 Schedule of Work, progress scheduling in accordance with Section 01 32 00 - Construction Progress Documentation.
 - .2 Schedule of submission of shop drawings, cutsheets in accordance with Section 01 33 00 - Submittal Procedures.

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- .3 Delivery schedule of specified equipment in accordance with Section 01 32 00 - Construction Progress Documentation.
 - .4 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
 - .5 Record drawings in accordance with Section 01 78 00 - Closeout Submittals.
 - .6 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
 - .7 Take-over procedures, acceptance, and warranties in accordance with 01 78 00 - Closeout Submittals.
 - .8 Monthly progress claims, administrative procedures, photographs, and holdbacks.
 - .9 Appointment of inspection and testing agencies or firms in accordance with Section 01 43 00 - Quality Assurance.
 - .10 Insurances and transcript of policies.
- .3 Comply with Region Representative's allocation of sheds, for access, traffic, and parking facilities.
 - .4 During construction coordinate use of site and facilities through Region Representative's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
 - .5 Comply with instructions of Region's Representative for use of temporary utilities and construction facilities.

1.6 ON-SITE DOCUMENTS

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.

- .3 Addenda.
- .4 Reviewed shop drawings.
- .5 List of outstanding shop drawings.
- .6 Change orders.
- .7 Other modifications to Contract.
- .8 Field test reports.
- .9 Copy of approved Work schedule.
- .10 Health and Safety Plan and other Safety related documents.
- .11 Manufacturers' installation and application instructions.
- .12 Labour conditions and wage schedules.
- .13 Other documents as specified.

1.7 SCHEDULES

- .1 Submit preliminary construction progress schedule in accordance with Section 01 32 00 - Construction Progress Documentation to Region's Representative.
- .2 After review by the Consultant and Region's Representative, revise and resubmit schedule to comply with project schedule requirements.
- .3 During progress of Work revise and resubmit at project progress meetings or as directed by Region's Representative.

1.8 SUBMITTALS

- .1 Make submittal to Region's Representative for review.
- .2 Submit preliminary shop drawings, product data and samples in accordance with Section 01 33 00 – Submittal Procedures for review for compliance with Contract Documents; for field dimensions and clearances, for relation to

available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Region's Representative.

- .3 Submit requests for payment for review to Region's Representative.
- .4 Submit requests for interpretation of Contract Documents, and obtain instructions through Region's Representative.
- .5 Process change orders through Region's Representative.
- .6 Deliver closeout submittals for review by Region's Representative.

1.9 COORDINATION

- .1 Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.
- .2 Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection and operation.
- .3 Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
- .4 Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair of all components, mechanical, electrical, and otherwise,
 - .1 Provide adequate clearances for installation and maintenance of equipment.
 - .2 Install work to permit removal of parts requiring periodic replacement or maintenance.
 - .3 Arrange pipes, ducts, raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, and control components.
 - .4 Doors and access panels shall be kept clear.
 - .5 Utilize space efficiently so that adequate accessibility is retained for future maintenance, repairs, modifications and additions.

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- .6 Check the locations selected for all sprinkler heads and check the Architectural reflected ceiling plans to prevent conflicts between the trades.
 - .7 Contractor is cautioned that, where specific dimensions are not indicated or where Drawings are schematic in nature, as with most Electrical and Mechanical Drawings, Contractor shall have sole responsibility to coordinate the work to meet this requirement.
 - .5 Make adequate provisions to accommodate items scheduled for later installation.
 - .6 Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work and completion within the specified Contract duration. Such administrative activities include, but are not limited to, the following:
 - .1 Preparation of Contractor's Construction Schedule.
 - .2 Installation and removal of temporary facilities and controls.
 - .3 Delivery and processing of submittals.
 - .4 Progress meetings.
 - .5 Start-up, check-out, and final acceptance of systems.
 - .6 Project closeout activities.
 - .7 Protection of existing and new work.
 - .7 Changes required in the Work of the Contract, caused by the Contractor's neglect to coordinate the work with others shall be made at the Contractor's own expense.

1.10 COORDINATION DRAWINGS

- .1 Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

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- .2 Contractor to submit to the Region's Representative, in AutoCAD format, coordination drawings, drawn accurately to a scale large enough to indicate and resolve conflicts.
 - .3 Indicating the functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - .4 Do not base coordination drawings on standard printed data.
 - .5 Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - .6 Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - .7 Indicate required installation sequences.
 - .8 Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
 - .9 Minor dimension changes and difficult installations will not be considered changes to the Contract.
 - .10 Region's Representative will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination. If Region's Representative determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Region's Representative will so inform Contractor, who shall make changes as directed and resubmit.

1.11 CLOSEOUT PROCEDURES

- .1 Notify Region's Representative when Work is considered ready for Substantial Performance.
- .2 Accompany Region's Representative on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with Region Representative's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to Region's Representative-occupied areas.

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Section 013113
Project Management and
Coordination

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- .4 Notify Region's Representative of instructions of items of Work determined in Region Representative's final inspection.

END OF SECTION

1.0 GENERAL**1.1 DOCUMENTS**

- .1 This section, along with the drawings, forms part of the contract documents and is to be read, interpreted and coordinated with all other parts.

1.2 WORK INCLUDED

- .1 The administration of Project Meetings;
- .2 Pre-construction Meeting; and,
- .3 Progress Meetings.

1.3 ADMINISTRATION OF PROJECT MEETINGS

- .1 The Consultant shall preside at meetings.
 - .1 A representative of the Contractor shall record the minutes, include significant proceedings and decisions, and identify “action by” parties.
 - .2 The Contractor shall reproduce and distribute copies of minutes to meeting participants, to affected parties not in attendance, to the Region’s Representative and Consultant within three days after each meeting.
- .2 The Consultant shall schedule and administer project meetings.
 - .1 Prepare agenda for meetings.
- .3 Distribute written notice of each unscheduled meeting three (3) days in advance of meeting date to Contractor, Region’s Representative and relevant Subcontractors.
- .4 The Region’s Representative shall provide physical space and make arrangements for meetings on site.
- .5 Representatives of Contractor, Subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the party each represents.

1.4 PRECONSTRUCTION MEETING

- .1 Within five (5) days after award of Contract, the Consultant, or Contractor shall request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

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- 2 Senior representatives of the Region, Consultant, Contractor, major Subcontractors, field inspectors will be in attendance.
 - 3 The Consultant shall establish a time and location of meeting and notify parties concerned five (5) days before meeting.
 - 4 The Consultant shall incorporate mutually agreed variations to Contract Documents into Agreement, prior to sending the agreement to the parties for signing.
 - 5 Agenda to include the following:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work, progress scheduling
 - .3 Shop drawings and schedule of shop drawing submissions.
 - .4 Requirements of temporary facilities, site signage, hoarding, dust protection, offices, storage sheds, utilities, fences.
 - .5 Delivery schedule of critical equipment.
 - .6 Site security.
 - .7 Contemplated change orders, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements
 - .8 Take-over procedures, acceptance, warranties.
 - .9 Monthly progress claims, administrative procedures, holdbacks.
 - .10 Appointment of inspection and testing agencies or firms.
 - .11 Insurances, transcript of policies.

1.5 PROGRESS MEETINGS

- .1 During course of Work the Consultant or the Contractor shall schedule progress meetings every two weeks, further progress meetings may be scheduled by Consultant, Contractor, or Region's Representative as required to expedite the Work.
- .2 Consultant, Contractor, major Subcontractors involved in the Work, Region's Representative when required, are to be in attendance.

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- .3 The Consultant shall notify parties minimum three (3) days prior to meeting of changed time or place.
 - .4 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems which impede construction schedule, conflicts.
 - .4 Progress, schedule, during succeeding work period.
 - .5 Corrective measures and procedures to regain projected schedule.
 - .6 Revisions to construction schedule.
 - .7 Review of off-site fabrication delivery schedules, if any.
 - .8 Review submittal schedules; expedite as required.
 - .9 Maintenance of quality standards.
 - .10 Pending changes and substitutions, Notices of Proposed Change, Change Orders.
 - .11 Review proposed changes for effect on construction schedule and on completion date.
 - .12 Other business.

2.0 PRODUCTS

Not applicable.

3.0 EXECUTION

Not applicable.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 78 00 - Closeout Submittals.

1.2 SCHEDULES REQUIRED

- .1 Submit schedules as follows:
 - .1 Construction Progress Schedule.
 - .2 Submittal Schedule for Shop Drawings and Product Data.
 - .3 Submittal Schedule for Samples.
 - .4 Product Delivery Schedule.
 - .5 Shutdown or closure activity.

1.3 CRITICAL PATH SCHEDULING

- .1 Include complete sequence of construction activities.
- .2 Include dates for commencement and completion of each major element of construction as follows.
 - .1 Site clearing.
 - .2 Site utilities.
 - .3 Foundation Work.
 - .4 Structural framing.
 - .5 Special Subcontractor Work.
 - .6 Equipment Installations.
 - .7 Finishes.
- .3 Show projected percentage of completion of each item as of first day of month.
- .4 Indicate progress of each activity to date of submission schedule.

- .5 Show changes occurring since previous submission of schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.
 - .4 Other identifiable changes.
- .6 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and impact on schedule.
 - .2 Corrective action recommended and its effect.
 - .3 Effect of changes on schedules of other prime contractors.

1.4 SUBMITTALS SCHEDULE

- .1 Include schedule for submitting shop drawings, product data, and samples.
- .2 Indicate dates for submitting, review time, resubmission time, last date for meeting fabrication schedule.

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION (NOT APPLICABLE)

END OF SECTION

1. GENERAL

- .1 This section specifies general requirements and procedures for Contractor's submissions of shop drawings, product data, samples and mock-ups to Consultant for review. Additional specific requirements for submissions are specified in the project specifications.
- .2 Do not proceed with work until relevant submissions are reviewed and approved by Consultant.
- .3 Present shop drawings, product data, samples and mock-ups in SI metric units.
- .4 Where items or information is not produced in SI units converted values are acceptable.
- .5 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submissions.
- .6 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Contractor's responsibility for deviation in submission from requirements of Contract Documents is not relieved by Consultant's review of submission, unless Consultant gives their written acceptance of specified deviations.
- .8 Make any changes in submissions which Consultant may require consistent with Contract Documents and resubmit as directed by Consultant.
- .9 Notify Consultant in writing when resubmitting of any revision other than those requested by the Consultant.

1.1 SUBMISSION REQUIREMENTS

- .1 Coordinate each submission with requirements of work and Contract Documents. Individual submissions will not be reviewed until all related information is available.
- .2 Submit 4 digital copies of product data, manufactures' catalogue sheets, brochures, literature, performance charts and diagrams.
- .3 Comply with the following requirements in regard to submission of product data:
 - .1 Delete information not applicable to project.
 - .2 Supplement standard information to provide details applicable to project.

- .3 Provide certification of compliance to applicable codes.
- .4 Provide manufacturers' certification as to current production.
- .4 Allow 5 working days for Consultant's review of each submission.
- .5 Accompany submissions with transmittal letter in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .6 Submission shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .7 After Consultant's review, distribute copies to all Region Representatives and subtrades if any.

1.2 SHOP DRAWINGS

- .1 Prior to commencing work, provide 1 set of digital shop drawings for the Consultant's review pertaining to installations and fabrications required by the Contract.
- .2 As part of the Consultant's field services, it will review shop drawings pertaining to work shown on engineering drawings by means of appropriate rational

sampling procedures and comment on the accuracy with which the Contractor prepared the drawings.

- .3 Review of shop drawings is for the sole purpose of ascertaining conformance with the general design concept and is not an approval of the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting them.
- .4 Review of shop drawings shall not relieve the Contractor of his responsibility for errors and omissions in the shop drawings or for meeting all requirements of the Contract Documents.
- .5 The Contractor is solely responsible for information pertaining to the fabrication process, techniques of construction and installation and for co-ordination of the work of all sub-trades.
- .6 Cross-reference shop drawing information to applicable portions of Contract Documents.

1.3 SAMPLES

- .1 Samples: examples of materials, equipment, quality, finishes, workmanship.
- .2 Where colour, pattern or texture is criterion, submit full range of samples.
- .3 Reviewed and accepted samples will become standard of workmanship and material against which installed work will be verified.

2.0 PRODUCTS

Not applicable

3.0 EXECUTION

Not applicable

END OF SECTION

1.0 GENERAL

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with Ontario Building Code (OBC) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code:
 - .1 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: stop work immediately should materials believed to contain asbestos be encountered during the execution of the work and notify Region's Representative. Do not proceed until written instructions have been received from Region's Representative. Perform asbestos abatement and repair in accordance with Asbestos Abatement Regulations, Latest Edition.
- .2 Mould: stop work immediately should material resembling mould be encountered during the execution of work and notify Region's Representative. Do not proceed until written instructions have been received from Region's Representative.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION (NOT APPLICABLE)

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 This section covers administrative and procedural Quality Control and Quality Assurance requirements for this Contract.
- .2 Quality control requirements include inspections, tests and related actions including reports performed by independent agencies, governing authorities, and the Contractor.
- .3 The Contractor is responsible for controlling the quality of work, including work of its subcontractors and suppliers, and for ensuring the quality specified in the Contract Documents is achieved.
- .4 Provisions for quality assurance apply to workmanship and craftsmanship applied to work executed in the performance of the Contract.
 - .1 Perform work with suitable qualified personnel to produce work of specified quality.
 - .2 Refer to applicable Codes and Standards.
 - .3 Refer to printed manufacturer's instructions.
 - .4 Refer to workmanship requirements of trade associations.
 - .5 Test materials in accordance with applicable standards.
 - .6 Provide field samples and mock-ups to establish acceptable level of quality and a basis for judging work.
 - .7 Follow inspection requirements.
- .5 Related work described elsewhere:
 - .1 Provisions of trade associations.
 - .2 Manufacturer's printed instructions.
 - .3 Recommendations, methods and criteria for applications and installation of systems and assemblies.
 - .4 Various technical sections of these Contract specifications and drawings.
 - .5 Provisions of work installed under this Contract furnished by others.

- .6 Testing and inspection services are required to verify compliance with the Contract Documents. These services do not relieve the Contractor of their responsibility for compliance with the Contract's requirements.
- .7 Various requirements for Quality Control of the Work are specified throughout the Contract Documents. These requirements shall be deemed the minimum requirements for the Work's quality and acceptability. The Contractor shall perform as many inspections and tests as necessary to verify that the Work conforms to the Contract's requirements.
- .8 Perform testing and inspections in accordance with, and as required by, all applicable codes, regulations, laws and requirements of authorities having jurisdiction.
- .9 Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - .1 Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production standards as well as customized fabrication and installation procedures.
 - .2 Inspections, tests and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with the Contract Document requirements.
 - .3 Requirements for the Contractor to provide Quality Control services are not limited by the provisions of this Section.

1.2 CONTRACTOR RESPONSIBILITIES

- .1 The Contractor shall perform the general responsibilities specified herein for both Quality Control and Quality Assurance requirements.
- .2 Coordinate sequence of activities to accommodate required Quality Assurance and Quality Control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
- .3 Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection and operation.
- .4 Coordinate, arrange, stage and sequence all testing and inspections, including obtaining samples.

- .5 Schedule times for tests, inspections, obtaining samples, and similar activities. Provide timely notice of the Work's readiness for all required tests and inspections.
- .6 Prepare a schedule of tests, inspections and similar quality control services required by the Contract Documents.
 - .1 Submit schedule within three (3) weeks from date of award of Contract.
 - .2 Distribute schedule to Region's Representative and each party involved in the performance of portions of the Work where tests and inspections are required.
- .7 Furnish labour, resources and facilities to:
 - .1 Provide safe access to work to be inspected and tested.
 - .2 Facilitate inspections and tests.
 - .3 Obtain and handle samples and materials required for inspections and tests.
 - .4 Make good work that is disturbed by inspecting and testing.
 - .5 Provide sufficient space to facilitate the storage, security, protection and curing of samples, as well as the storage of testing and inspection equipment.

1.3 QUALIFICATIONS

- .1 Project Superintendent
 - .1 The Contractor shall engage a qualified person who is thoroughly trained and experienced in the duties of a Project Superintendent to oversee the total overall Work of this Contract.
- .2 Subcontractors
 - .1 Trade subcontractors involved in work of this Project shall be administered, supervised and directed by at least one qualified journeyman foreman who is thoroughly trained and skilled in the arts generic to their trade and such qualifications may be subject to review by the Region's Representative.
- .3 Workers
 - .1 Workers engaged in the performance of work of this Project shall be skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work.

- .2 Workers shall be thoroughly trained and experienced in the installation of the specified and selected products, and who are completely familiar with the requirements of their respective work and this Work.
- .4 Fabricators, Suppliers, Installers and Personnel
 - .1 A firm or individual experienced in producing, installing, erecting or assembling products similar to those indicated for this Project, and with a record of successful in-service performance.
 - .2 Fabricators, erectors, suppliers, installers, and applicators shall have not less than five (5) years continuous experience in the execution of their respective duties, and their qualifications may be subject to review and approval by the Region's Representative.
- .5 Manufacturer
 - .1 A firm experienced in manufacturing products or systems similar to those indicated for this Project, and with a record of successful in-service performance.

1.4 QUALITY CONTROL

- .1 The Contractor shall corporate with agencies performing required inspections, tests and similar services, and provide reasonable auxiliary services as requested. Auxiliary services required but are not limited to:
 - .1 Providing access to the Work and furnishing incidental labour and facilities necessary to facilitate inspections and tests.
 - .2 Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - .3 Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
 - .4 Security and protection of samples and test equipment at the Project site.
- .2 Notify the agency sufficiently in advance of operations to permit assignment of personnel.
- .3 The Contractor is responsible for retesting costs where results of required inspections, tests or similar services prove unsatisfactory and do not meet the requirements of the Contract Documents, regardless of whether the original test was the Contractor's responsibility.
 - .1 Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility.

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- .4 The independent testing agency shall cooperate with the Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
 - .1 The agency shall notify the Region's Representative and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - .2 The agency shall determine the location from which test samples will be taken or where tests are conducted.
 - .3 The agency shall conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - .4 The agency shall submit a certified written report of each test, inspection, and similar quality assurance service to the Region's Representative, with a copy to the Contractor.
 - .5 The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
 - .6 The agency shall not perform any duties of the Contractor.
 - .6 Where tests and inspections are indicated as Contractor's responsibility, provide quality control services specified and those required by authorities having jurisdiction.
 - .1 Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - .7 Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services.
 - .1 Contractor shall not employ same entity engaged by the Region's Representative, unless agreed to in writing by the Region's Representative.
 - .8 Where quality control services are indicated as Contractor's responsibility, submit a certified written report of each quality control service.
 - .9 Testing and inspecting requested by the Contractor and not required by the Contract Documents are the Contractor's responsibility.
 - .10 Submit additional copies of each written report directly to authorities having jurisdiction, when directed so.

- .11 Where quality control services are the Contractor's responsibility, provide quality control services, including retesting and re-inspecting, for construction that replaces or is necessitated by Work that failed to comply with the Contract Documents.

1.5 REPAIR AND PROTECTION

- .1 Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
- .2 Protect construction exposed by or for quality control service activities, and protect repaired construction.
- .3 Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.
- .4 Remove and replace work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.

1.6 COVERED WORK

- .1 If any work designated for testing and inspecting is covered or permitted to be covered, the Contractor shall uncover the work at their own cost to allow for completion of testing and inspecting.

1.7 NON-CONFORMING, REPERFORMANCE AND REMEDIAL WORK

- .1 Where the Contractor's Quality Control and Quality Assurance programs reveal Work which does not conform to the Contract's requirements, regardless of the reason for non-conformance and whether incorporated into the Work or not, the Contractor shall promptly perform the following:
 - .1 Submit details of the proposed remedial work to the Region's Representative for review prior to performing remedial work on the affected item.
 - .2 Remove and replace or re-execute the work in accordance with the Contract Documents and at the Contractor's own expense.
 - .3 The Contractor shall repair and replace products and materials, correct defects, re-execute work and reperform testing and inspections as necessary to ensure that the Work conforms to the Contract's requirements. Work damaged or destroyed by such corrections shall be promptly made good by the Contractor at their own expense.

- .4 If Quality Assurance and/or Quality Control testing on a portion of the Work not tested by the Contractor identifies a non-conformance to the Contract's requirements, the Contractor shall have the option to either arrange for an independent reperformance of the test at their own expense or correct the non-conforming work and perform a retest.
- .5 The Region's Representative reserves the right to request that the Contractor perform additional inspection and testing to determine the full extent of defects revealed by the Quality Control and Quality Assurance programs.
- .6 The Contractor shall perform retesting and remedial work until the Work meets Contract requirements.

1.8 CONFLICTING REQUIREMENTS

- .1 Throughout the Contract specifications, reference to various industry standards may be made. Conform to the latest version of such standards available at the time of tendering, in whole or in part, as specified.
- .2 If there are questions as to whether any product of system is in conformance with applicable standards, the Region's Representative reserves the right to have such products or systems tested to prove or disprove conformance with Contract Documents, or by the Contractor in the event of non-conformance.
- .3 Copies of applicable referenced standards are not included in the Contract Documents. Where copies of standards are needed by the Contractor for superintendence and quality control of the work, the Contractor shall obtain a copy or copies directly from the publication source and maintain at the jobsite, available to the Contractor's personnel, subcontractors, and Region's Representative.
- .4 If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to the Region's Representative for a decision before proceeding.

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION (NOT APPLICABLE)

END OF SECTION

1.0 GENERAL**1.1 WORK INCLUDED**

- .1 Protection of the Work, Work in Progress, Property and Persons by all Sections.

1.2 WALK-THROUGH INSPECTION OF SITE

- .1 Prior to start of Work, Contractor, Consultant and Region's Representative will perform walk-through inspection of site to determine existing conditions.
- .2 The Contractor is to perform a thorough inspection of the site prior to the start of work and provide a written notice to the Consultant detailing all damaged property as well as all items that appear to be of poor working order or appearance (i.e. sign, fixtures, dirt, etc.).
- .3 Upon receiving this notice, the Consultant and the Region's Representative will verify the validity of the items listed.
- .4 If written notice is not given within five (5) days of commencement of Work, it will be assumed that the Contractor has reviewed the site and has accepted the condition of the property as being free of damage.
- .5 Any damages not listed as part of the written notice above found after the completion of the work will be the sole responsibility of the Contractor to rectify. These rectifications shall be completed in a timely and satisfactory manner.
- .6 The project will not be considered substantially performed if the cost to correct these outstanding deficiencies is greater than the limits outlined in the Construction Lien Act.

1.3 THE WORK, WORK IN PROGRESS, PROPERTY AND PERSONS

- .1 Provide protection as required to protect work in progress and other property from damage and to provide suitable conditions for the progress of finishing work.
- .2 Take reasonable and required measures, including those required by authorities having jurisdiction, to protect the public and those employed on the Work from bodily harm.
- .3 Comply with requirements of the Occupational Health and Safety Act, R.S.O. 1990, c. O.1 (OHSA) and Regulations for Construction Projects.
- .4 Direct all Subcontractors to protect their own work, existing property, adjacent public and private property and work of other Sections from damage while working.

1.4 CONSTRUCTION SIGNAGE

- .1 Contractor shall provide all required signage necessary to protect the public from the construction, control the traffic flow through the garage and the work area and to inform patrons that construction activity is in process.
- .2 Additional signs may be required at the discretion of Region's Representative or Consultant as construction progresses. No extras will be entertained for signage requirements after tenders close.
- .3 All signage to be of professional quality and design.
- .4 Typical signage that may be required are as follows:
 - .1 two-way traffic
 - .2 keep right or left
 - .3 yield, stop, detour
 - .4 one way traffic
 - .5 no parking, directional arrows, etc.
- .5 Signage will be required at all entrances to the 'Work Area'. This signage shall consist of the standard "Men at Work" sign with an additional sign (special order) indicating that the site is temporarily under construction and we are sorry for the inconvenience.
- .6 Typical additional non-standard signage that will be required is as follows:
 - .1 Site Temporarily Under Construction - Sorry for the Inconvenience
 - .2 This Section of Site Closed For Repairs
 - .3 Caution 2-Way Traffic, Proceed When Way is Clear (with directional arrows).
- .7 All non-standard signage is to be of adequate size (discuss with Consultant prior to ordering) with orange background and large black letters and decals. Plywood backing is sufficient. All signs are to be of professional quality.
- .8 All signage is to be securely fastened directly to hoarding or if signage is required and hoarding is not available, the signs are to be securely fastened to 2 screw jack (post shores) which are fully tightened to the slab soffit and slab surface. Signs and posts are to be installed in such a manner that projections that may cause public injury are not created.

1.5 CONSTRUCTION BARRIERS AND ENCLOSURES

- .1 Contractor shall supply and construct hoarding, barriers and enclosures as indicated in these specifications, drawings and as directed by the Consultant or Region's Representative as the construction progresses.
- .2 No extras shall be entertained for hoarding, barriers and enclosures after tenders close unless the scope of work is significantly changed.

1.6 EXISTING BUILDINGS, CURBS, ROADS AND LANES

- .1 Protect existing buildings, structures, curbs, roads and lanes. If, during work, any existing items are damaged, repair or replace them.
- .2 Provide pavement, curb and sidewalk protection for public thoroughfares and the Work in progress as required by the authorities and to protect public property and the Work.

1.7 CONTROL OF CONSTRUCTION GENERATED DUST, DEBRIS, FUMES, ETC.

- .1 Dust, dirt, construction debris, water and fumes from the work areas must not be permitted to enter areas of the building or rooms in or adjacent to work areas.
- .2 All catch basins within work area to be covered by a filter cloth before commencement of project. Filter to be maintained and to be removed by the Contractor at the end of the project.

1.8 PROTECTION OF EXISTING EXPOSED FACILITIES

- .1 Existing lighting system within work area is to be protected from damage or removed and re-installed upon completion of repairs.
- .2 All exposed conduit, fixtures, attached devices, sprinkler fire system plumbing, mechanical system components, louvers and ducts are to be protected against the accumulation of dust, debris and damage. The Contractor will be responsible to correct any damages to these systems at his own expense. Contractor to promptly report any damage to the Region's Representative and the Consultant.
- .3 Protect existing control equipment, overhead doors, etc. from damage.
- .4 Inspect materials, equipment and components to be re-used or turned over to the Region's Representative. Note their condition and advise Consultant in writing of any defects or conditions which would affect their removal and re-use, prior to removal.
- .5 Any damage to the paint finish of the walls or columns caused by the construction shall be repaired by the Contractor at no cost to the Region.

1.9 FIRE PROTECTION

- .1 Take necessary precautions to eliminate fire hazards and to prevent damage to the Work, building materials, equipment and other property both public and private having to do with the Work. Inspect the Work at least once a week for this purpose.
- .2 Store and locate products and equipment packed in cardboard cartons, wood crates and other combustible containers in orderly and accessible manner. Place approved types of firefighting equipment in vicinity of products packed in this type of crate or carton until permanent fire protection and equipment are available.
- .3 Open fires or burning of rubbish or debris are not permitted on the Site.

2.0 PRODUCTS

- .1 Not applicable

3.0 EXECUTION

- .1 Not applicable

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Manufacturer's instructions.
- .3 Quality of Work, coordination and fastenings.

1.2 RELATED SECTIONS

- .1 Section 01 43 00 – Quality Assurance.
- .2 Section 01 73 00 – Execution.

1.3 REFERENCES

- .1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.4 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Region's Representative based upon requirements of Contract Documents.
- .4 Within seven (7) working days of written request by Region's Representative, submit following information for material and equipment proposed for supply:
 - .1 Name and address of manufacturer.
 - .2 trade name, model and catalogue number,

- .3 performance, descriptive and test data,
- .4 manufacturer's installation or application instructions,
- .5 evidence of arrangements to procure.
- .5 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

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

1.6 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Region's Representative.
- .9 Touch-up damaged factory finished surfaces to Region Representative's satisfaction. Use touch- up materials to match original. Do not paint over name plates.

1.7 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.

1.8 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Region's Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Region's Representative may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Region's Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.9 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Region's Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Region's Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Region's Representative, whose decision is final.

1.10 CO-ORDINATION

- .1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.11 CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Region's Representative if there is interference. Install as directed by Region's Representative.

1.12 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of the Work.

1.13 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Region's Representative of conflicting installation. Install as directed.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Region's Representative.

1.14 FASTENINGS GENERAL

- .1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fasteners, anchors and spacers for securing exterior

work, unless stainless steel or other material is specifically requested in affected specification section.

- .2 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood plugs are not acceptable.
- .3 Conceal fasteners where indicated. Space evenly and lay out neatly.
- .4 Fastenings which cause spalling or cracking are not acceptable.
- .5 Obtain Region Representative's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166.

1.15 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Region's Representative.

1.17 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute work at times directed by local governing authorities, with minimum of disturbance to work.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.
- .3 Submit schedule to and obtain approval from Region's Representative for any shut-down or closure of active services or facility. Adhere to approved schedule and provide notice to affected parties.

- .4 Where unknown services are encountered, immediately advise Region's Representative and confirm findings in writing.
- .5 Remove abandoned services lines within 2.0 m of structures. Cap or otherwise seal lines at cut-off points as directed by Region's Representative.

1.18 SELECTION OF MATERIAL AND EQUIPMENT

- .1 Material and equipment will be specified in the tender documents, and selected by Contractor, by one or more of the following methods:
 - .1 Specification by reference to a relevant Standard, such as CSA, ASTM, ULC, etc., select any material or equipment that meets or exceeds the specified.
 - .2 Specification by reference to an accepted product evaluation publication, such as the CGSB "Qualified Products List", or CCMC Registry of Product Evaluations", - select any manufacturer's product so listed.
 - .3 Specification by Prescriptive or Performance specification – select any material or equipment meeting or exceeding specification.
 - .4 Specification by identification of one or more Manufacturer's specific product(s) as an "Acceptable Product", along with a listing of other manufacturers who may offer equivalent products – select any product so named, or select from equivalent product(s) of other listed manufacturers.
- .2 "Acceptable Product" is deemed to be a complete and working commodity as described by a manufacturer's name, catalogue number, trade name, or any combination thereof, and will constitute the minimum standard of acceptance.
- .3 Region's Representative will determine acceptability of Contractor's selection of material and equipment at time of Shop Drawing review.
- .4 When material or equipment is specified by a Standard, Prescriptive or Performance specification, upon request of the Region's Representative, obtain from manufacturer an independent laboratory reporting, showing that material or equipment meets or exceeds the specified requirements.

1.19 SUBSTITUTION OF MATERIAL AND EQUIPMENT

- .1 Substitution prior to Tender closing will be considered by Region's Representative only if the conditions of Section 01 23 10 – Alternates are met.

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Section 016100
Common Product
Requirements

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- .2 After Contract award substitutions of material or equipment, other than as selected by Contractor from those specified, will be considered by Region's Representative only if the conditions of Section 01 23 10 – Alternates are met.
 - .3 Requests for substitutions after Contract award must be accompanied by sufficient information in the form of shop drawings, manufacturer's literature, samples or other data to permit proper investigation of the substitutes used. Requests must also include statements of respective costs of material or equipment originally specified and the proposed substitution.
 - .4 Should a proposed substitution be accepted after Contract award either in part or in whole, assume full responsibility and costs when substitution affects other work on Project. Contractor to pay for design or drawing changes required as a result of the substitution.
 - .5 Amounts of all credits arising from approval of substitutions after Contract award will be determined by Region's Representative and the Contract amount will be reduced accordingly.

2.0 PRODUCTS (NOT APPLICABLE)**3.0 EXECUTION (NOT APPLICABLE)****END OF SECTION**

1.0 GENERAL

1.1 RELATED SECTIONS (NOT APPLICABLE)

1.2 SECTION INCLUDES

- .1 Common requirements for installing, applying, and erecting products. Includes procedures and submittals for cutting and patching to existing conditions and required repairs arising from tests and destructive inspections.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit proof of anchor and fastener load carrying capacity for a work result, when requested.
- .3 Submit written request before cutting or altering to existing conditions which may affect the following:
 - .1 Structural integrity of existing elements: Submit structural details and calculations performed by a professional structural engineer registered or licensed in Ontario, Canada. Include evidence of unsatisfactory structural integrity of the elements according to Region's Representative.
 - .2 integrity of weather-exposed and moisture-resistant elements.
 - .3 efficiency, maintenance, safety, or accessibility of operational elements.
 - .4 visual qualities of sight-exposed elements.
 - .5 Work of Region's Representative or separate contractor.
- .4 Submit a request for cutting or altering which includes:
 - .1 identification of the Project; and
 - .2 location and description of affected existing conditions including changes to structural elements, function of elements, and visual appearance of existing elements; and the location and identification of utilities that will be temporarily out of service during cutting and patching activities.
- .5 Submit site plan drawings indicating relative location of various services and equipment upon the request of Region's Representative.
- .6 Submit a work plan including:

- .1 a statement why cutting or altering is unavoidable and describe alternatives to cutting and patching if available;
- .2 a description of proposed work and proposed Products;
- .3 the effect of cutting or altering on work by Region's Representative or other contractors;
- .4 written acknowledgement by other contractors affected by cutting or altering, if applicable; and
- .5 proposed date(s) [and time(s)] work will be executed.

1.4 QUALIFICATIONS

- .1 Licensed Professionals: Engage a structural engineer licensed at the Place of the Work, to submit details and calculations when altering existing structural elements.

2.0 PRODUCTS

2.01 MATERIALS

- .1 Patching Materials: If possible, use the same materials found in the existing conditions, except in fire-resistance rated materials and assemblies.
- .2 Materials Visible from the Floor Area: Use materials that visually match existing adjacent surfaces and match existing functional performance.

3.0 EXECUTION

3.01 COMMON INSTALLATION/APPLICATION/ERECTION REQUIREMENTS

- .1 Fit several parts together, to integrate with other Work.
- .2 Remove and replace defective and non-conforming Work.
- .3 Unless otherwise indicated in specifications, install, or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .4 Notify Region's Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Region's Representative will establish course of action.
- .5 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Region's Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

- .6 Provide openings in non-structural elements for penetrations of mechanical and electrical work.
- .7 Conceal pipes, ducts and wiring in floor, wall, partition, and ceiling assemblies in finished areas, except where indicated otherwise.
- .8 In addition to the manufacturer's recommendations for safety, access, accessibility, and maintenance, locate equipment, fixtures, and distribution systems where it shall provide minimal interference and shall maximize on usable space.
 - .1 Location of equipment, fixtures, and outlets indicated on Drawings and specifications are approximate.
 - .2 Notify Region's Representative of impending installation and obtain approval for actual locations.

3.02 BRACING AND ANCHORING

- .1 Anchors and Fasteners: Unless otherwise indicated elsewhere:
 - .1 Provide any necessary anchors and fasteners to fasten each component securely for its intended purpose. Allow for building movement, including from thermal expansion and contraction of materials and assemblies;
 - .2 prevent electrolytic reaction between dissimilar metals and materials;
 - .3 Provide [hot-dip galvanized] [stainless] steel anchors and fasteners for securing exterior work;
 - .4 locate anchors and fasteners within individual load limit or shear capacity. Ensure anchors and fasteners are permanently secured
 - .5 Where exposed to view, evenly distribute anchors and fasteners in a single area; and
 - .6 Where exposed to view, provide metal anchors, fasteners, and related accessories with the same texture, colour, and finish as adjacent materials.
- .2 Non-Conforming Work: Anchors and fasteners installed which cause substrate cracks or spalling is not acceptable.

3.03 CUTTING AND PATCHING

- .1 Proceed with cutting and patching after the review and acceptance by the Region's Representative of all submittals listed.

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- .2 Perform cutting, fitting, and patching [including excavation and fill,] to complete Work in accordance with related technical specification Sections.
 - .3 Use special techniques to avoid damaging existing conditions that will remain, and which will result in proper surfaces to receive patching and finishing.
 - .4 Employ original installer to perform cutting and patching for weather-exposed elements, moisture-resistant elements, and surfaces exposed to view.
 - .5 Cut rigid materials using masonry saw, core drill, or other tool recommended by the product manufacturer or applicable industry association. Pneumatic or impact tools are not allowed on masonry work without the approval of Region's Representative.
 - .6 Fit Work [airtight] to pipes, sleeves, ducts, conduit, and other penetrations through surfaces
 - .7 Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to nearest intersection (e.g., edges of partition). [Refinish assemblies by refinishing entire unit.] Provide entire surface with uniform finish, colour, and texture.

3.04 ADJUSTING

- .1 Remove and replace patching that is visually unsatisfactory to Region's Representative.

END OF SECTION

1.0 GENERAL

- .1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
- .2 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .3 Provide adequate ventilation during use of volatile or noxious substances. Use for building ventilation systems is not permitted for this purpose.

1.1 RELATED SECTION

- .1 Section 01 78 00 - Closeout Submittals.

1.2 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Region's Representative or other Contractors.
- .2 Remove waste materials and debris from site at the end of each working day. Do not burn waste materials on site.
- .3 Clear snow and ice from access to building, when needed.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.
- .7 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
- .11 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 – Construction Waste Management and Disposal.
- .12 Dispose of waste materials and debris at designated dumping areas off site.

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 When the Work is Totally Performed, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the Region's Representative or other contractors.
- .4 Remove waste materials from the site at regularly scheduled times or dispose of as directed by the Region's Representative. Do not burn waste materials on site.
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6 Leave the work broom clean before the inspection process commences.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fittings, walls, floors and ceilings.

- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean roofs, gutters, downspouts and drainage systems. Clean areaways and sunken wells.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .18 Remove snow and ice from access to building.
- .19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION (NOT APPLICABLE)

END OF SECTION

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PART 1 GENERAL

1.1 DESCRIPTION OF WORK INCLUDED

- .1 Provide all labour, material, equipment and services necessary to dispose of all waste products and debris in the work area as indicated on the Contract Documents.

1.2 GENERAL REQUIREMENTS

- .1 Store volatile wastes in covered metal containers and remove from premises daily.
- .2 Prevent accumulation of wastes which create hazardous conditions.
- .4 Co-ordinate requirements for ventilation and waste disposal operation with the Property Manager.

1.3 REFERENCES

- .1 Waste Control Regulations - Comply with the requirements of the Occupational Health and Safety Act.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

3.1 PRIOR TO CONSTRUCTION

- .1 Prior to the submission of a Bid for this project, the Contractor shall examine the site to determine its condition with respect to debris and dust.

3.2 WASTE REMOVAL DURING CONSTRUCTION

- .1 Maintain the place of work and adjacent properties free from accumulations of waste materials and rubbish.
- .2 Provide on-site containers for collection of waste materials and rubbish.
- .3 Disposal of all waste products to be performed in accordance with the product manufacturer's Material Safety Data Sheets, and in accordance with the Occupational Health and Safety Act.

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- .4 Seal off all work areas to prevent dust and debris being generated from affecting other areas, including construction access requirements. Any dust and debris which escapes from the work area, is to be cleaned up in a timely fashion. If deemed by the Consultant, this cleaning operation has not been performed in a timely fashion, the Region's Representative may contract an independent cleaner to rectify the situation. The cost of which will be back charged to the Contractor.

END OF SECTION

1.0 GENERAL**1.1 WARRANTY/ GUARANTEE PERIOD**

- .1 All of the Work of the Contract: Two (2) year guarantee, secured by the Performance Bond for the first 2 years as noted above, commencing on the date of Substantial Performance.
- 2 Any required maintenance of any of the work is to be performed by the Contractor for the duration of the Warranty Period, at no extra cost.

2.0 EXECUTION**2.1 REMEDIAL WORK UNDER WARRANTY**

- .1 The Region's Representative shall provide written notice to the Contractor, within thirty days of the discovery of any defect in the system under normal usage. The Contractor shall immediately take necessary steps to protect the area against further damage and shall take corrective action to make good any damage incurred. The Contractor shall schedule all repair work with the Region's Representative and shall make every attempt to make good the defects within 3 weeks of notification.
- 2 Remedy is to include (at no cost to the Region) labour, materials, equipment, and services required to make good defective areas of the Work and to make good damages resulting from obtaining access to defective areas, including repairs to waterproofing, etc. The Contractor will reimburse the Region's Representative for any resulting investigation costs to define the extent of defective areas and to re-test to confirm acceptability of repairs. In addition, the Contractor is responsible for all associated costs resulting from stall closure, including the costs of alternate parking.
- 3 Warranty periods for the areas requiring repair are to be extended by the amount of time between notification that the remedial work is necessary and the completion of the remedial work, thereafter the warranty period will re-commence upon completion of the remedial work.
- 4 Warranties are not to be deemed to restrict any liability of the Contractor arising out of any applicable law.

END OF SECTION

1.0 GENERAL**1.1 SECTION INCLUDES**

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

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Submit one binder hardcopy and one electronic copy of completed volumes in final form 15 days prior to final inspection.
- .3 Copy will be returned after final inspection, with Region Representative's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two weeks prior to Substantial Performance of the Work, submit to the Region's Representative, two final copies of operating and maintenance manuals.
- .6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .7 If requested, furnish evidence as to type, source and quality of products provided.

- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.4 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide CAD files in DWG format via digital submission. Also provide electronic files in PDF format.

1.5 CONTENTS - EACH VOLUME

- .1 Binder Cover, Edge, and Title Page: Project Name, Building Name, address, project number (GOC#), Project Substantial Completion Date (ex. October 2016), Volume and Elements of Project Contained in Manual
- .2 Table of Contents: A fully detailed index of the O&M Manual. Title/Page number etc. Provide title of project; names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; schedule of products and systems, indexed to content of volume.
- .3 Tab A – Contact information: Include contact information for consultant, 3rd Party Cx Agent (If required), General Contractor and all Sub-Contractors. Complete list of names, addresses, telephone numbers of contractor,

subcontractor, suppliers, 24-hour emergency service numbers for each supplier in this section.

- .4 Tab B – Signed letters of Warranty and Substantial Completion Letter: Signed and dated warranty letters to include project name, project number (GOC#), location, warranty start date (to be the date of Substantial Completion as declared by consultant), and all manufacturer and extended warranties.
- .5 Tab C – Shop Drawings: A copy of all Shop Drawings reviewed by the Consultant and/or Third-Party Commissioning Agent including associated project specifications. Include shop drawing log.
- .6 Tab D – System Operation: Expand on the way in which each of the systems operates.
 1. Start-Up, interfaces/interlocks
 2. Setpoints
 3. Running
 4. Sequences of Operation:
 - a. Provide Designers operating requirements
 - b. Building Automation Control drawings and final sequence of operations.
 5. Shut down, interfaces/interlocks
 6. Copies of all TAB reports
 7. Permits or certifications from Authorities having jurisdictions
- .7 Tab E – Manufacturers Literature/Information: Include all the manufacturer's information (IOM) relating to the equipment, ancillaries, and systems.
- .8 Tab F –As Built Drawings: Marked in red ink by the Contractor.
- .9 Tab G - Building Item (Equipment) Data Collection Forms (CMMS): A copy of all completed (and approved) CMMS Data Sheets for all equipment which was new, removed, modified, added, decommissioned, or replaced.
- .10 Tab H – Consultant Site Inspection Reports: Inspection report(s) conducted during the implementation of the project.

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- .11 Tab I – Training Records: A copy of all training schedules, attendance records. Indicate if training sessions were recorded.
 - .12 Tab J – Disposal of Equipment: Submit copies of transportation documents or shipping manifests indicating weights of materials, and other evidence of disposal indicating final location of waste diverted from landfill and waste sent to landfill.
 - .13 Tab K – Handover Spare Parts: Provide inventory spare parts and maintenance materials in quantities specified in individual spec sections and special tools of same quality and manufacture as products provided in Work. Provide a list of spares that are recommended to be held by the operator/facilities department.
 - .14 Tab L – Final Commissioning Report – Consultant or 3rd Party: Final Commissioning report to consist of an executive summary and include all commissioning documentation completed and/or reviewed by the commissioning agent.
 - .15 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - .16 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
 - .17 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
 - .18 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
 - .19 Training: Refer to Section 01 91 13 – General Commissioning (Cx) Requirements.

1.6 AS-BUILTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Region's Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.

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- .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
 - .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
 - .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
 - .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
 - .5 Keep record documents and samples available for inspection by Region's Representative.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of blue line opaque drawings, provided by Region's Representative.
- .2 Provide felt tip marking pens, maintaining red color pens for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.

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- .7 References to related shop drawings and modifications.
 - .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
 - .6 Other Documents: submit manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
 - .7 At completion of project, provide all recorded information on print drawings. Transfer recorded information to AutoCAD files in DWG format. Submit DWG files, also with electronic files in PDF format as part of the Closeout Submittals.

1.8 FINAL SURVEY

- .1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.9 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.

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- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - .10 Provide installed control diagrams by controls manufacturer.
 - .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
 - .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
 - .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - .14 Include test and balancing reports
 - .15 Additional requirements: As specified in individual specification sections.

1.10 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.11 SPARE PARTS

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

1.12 MAINTENANCE MATERIALS

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

1.13 SPECIAL TOOLS

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

1.14 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Region's Representative.

1.15 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan to Region Representative's approval.
- .3 Warranty management plan to include required actions and documents to assure that Region's Representative receives warranties to which it is entitled.

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- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
 - .5 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
 - .4 Except for items put into use with Region Representative's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
 - .5 Verify that documents are in proper form, contain full information, and are notarized.
 - .6 Co-execute submittals when required.
 - .7 Retain warranties and bonds until time specified for submittal.
 - .6 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems, and lightning protection systems.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.

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- .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Procedure and status of tagging of equipment covered by extended warranties.
 - .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
 - .7 Respond in a timely manner to oral or written notification of required construction warranty repair work.
 - .8 Written verification will follow oral instructions. Failure to respond will be cause for the Region's Representative to proceed with action against Contractor.

1.16 PRE-WARRANTY CONFERENCE

- .1 Meet with Region's Representative to develop understanding of requirements of this section.
Schedule meeting prior to contract completion, and at time designated by Region's Representative.
- .2 Region's Representative will establish communication procedures for:
 - .1 Notification of construction warranty defects.
 - .2 Determine priorities for type of defect.

-
- .3 Determine reasonable time for response.

1.17 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Region's Representative.
- .2 Leave date of acceptance until project is accepted for occupancy.
- .3 Indicate following information on tag:
- .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION (NOT APPLICABLE)

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES:

- .1 This Section specifies roles and responsibilities of Commissioning Training.

1.2 RELATED SECTIONS:

- .1 Section 01 78 00 – Closeout Submittals.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining this facility including, but not limited to, Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees may be available for training during any stage of construction.

1.4 INSTRUCTORS

- .1 The Cx Manual will contain:
 - .1 Descriptions of systems.
 - .2 Instruction on design philosophy, design criteria, and design intent.
- .2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, shut-down and maintenance of equipment, components and systems.
 - .2 Control features and reasons for, results of, implications on associated systems of adjustment of set points of control and safety devices.
 - .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
 - .4 Training to be completed after Installation and Performance Verification are completed.

1.5 TRAINING OBJECTIVES

- .1 Training to be detailed and of sufficient duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective on-going inspection, measurements of system performance.
 - .3 Proper preventive maintenance, diagnosis, trouble-shooting and maintenance.
 - .4 Ability to update documentation.
 - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.6 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality. Provide copies for all those in attendance.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 Testing, adjusting and balancing and performance verification reports where applicable.
- .3 Region's Representative will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to the same degree of detail with or without the instructor.

1.7 SCHEDULING

- .1 Contractor to include in schedule time for training. Provide a detailed commissioning schedule indicating all Cx tasks and training.
- .2 Deliver training during regular working hours, training sessions to be determined in Commissioning meetings.
- .3 Training to be completed prior to Substantial Completion.

1.8 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
- .2 Region's Representative will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Region's Representative. Include list of those in attendance. The Cx manual will provide templates for these submittals.

1.9 TRAINING CONTENT

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.
 - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
 - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
 - .7 Maintenance and servicing.
 - .8 Trouble-shooting diagnosis.
 - .9 Inter-Action among systems during integrated operation.
 - .10 Review of O&M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

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Building Systems Upgrade – HVAC, LED and Nursing Call, 2387 Industrial St, Burlington

Section 017900.13
Demonstration and Training for
Building Commissioning

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION (NOT APPLICABLE)

END OF SECTION

1.0 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.

1.2 SUMMARY

- .1 This Section includes general requirements relating to commissioning (Cx) of project components and systems, specifying general requirements for performance verification (PV) of components, equipment, sub-systems, systems, and integrated systems.

1.3 ABBREVIATIONS

- .1 BMM: Building Management Manual
- .2 Cx: Commissioning
- .3 EMCS: Energy Monitoring and Control Systems
- .4 O&M: Operation and Maintenance
- .5 PI: Product Information
- .6 PV: Performance Verification
- .7 TAB: Testing, Adjusting and Balancing

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Region's Representative and/or Consultant will observe some or all commissioning activities at their discretion.
 - .2 Region Representative's Performance Testing: Performance testing of equipment or systems by Region's Representative and/or Consultant will not relieve Contractor from compliance with specified start-up and testing procedures.
 - .3 Cooperate fully with Region's Representative and/or Consultant during stages of acceptance and occupancy of facility.
 - .4 Coordination with Authorities Having Jurisdiction (AHJ):
 - .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of AHJ, arrange for authority to witness procedures to avoid duplication of tests and to facilitate an earlier acceptance of facility.
 - .2 Obtain certificates of approval, acceptance, and compliance with rules and regulations of AHJ.

-
- .3 Submit copies to Region's Representative and/or Consultant within [5] days of test and Cx test.
 - .2 Commissioning Meetings:
 - .1 Hold Cx meetings after project meetings
 - .2 Use Cx meetings to resolve issues, monitor progress, and identify defects and deficiencies relating to Cx.
 - .3 Continue Cx meetings on a regular basis, including during equipment start-up period, and functional testing period until commissioning deliverables have been addressed.
 - .4 At [60]% construction completion stage: Region's Representative and/or Consultant will request a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Agenda topics include the following:
 - .1 Review duties and responsibilities of Contractor and Subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of Subcontractors and manufacturer's representatives in the Cx process.
 - .5 Meeting will be chaired by Region's Representative and/or Consultant [Cx Agent], who will record and distribute minutes.
 - .6 Ensure Subcontractors and relevant manufacturer representatives are present at [60]% construction completion stage, at subsequent Cx meetings, and when otherwise required.
 - .3 Observation of Starting and Testing:
 - .1 Give [14] days notice before beginning commissioning.
 - .2 Region's Representative and/or Consultant will observe start-up and testing.
 - .3 Region Representative's Cx Agent to be present at tests performed and documented by Subcontractors, suppliers, and equipment manufacturers.
 - .4 Conflicts:
 - .1 Report conflicts between requirements of this Section and other Sections to Region's Representative and/or Consultant and obtain interpretation or clarification before starting commissioning work.
 - .2 Failure to report conflicts and obtain interpretation or clarification will result in application of the more stringent requirement.

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit no later than 4 weeks after award of Contract:
 - .1 name of Region Representative's Cx agent,
 - .2 draft Cx documentation, and

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- .3 preliminary Cx schedule.
 - .3 Request changes to submittals in writing to Region's Representative and/or Consultant and obtain written acceptance or rejection at least [8] weeks before start of Cx.
 - .4 Where Cx procedures are not specified, submit proposed ones to Region's Representative and/or Consultant and obtain written acceptance or rejection at least [8] weeks before start of Cx.
 - .5 Submit additional documentation relating to Cx process as required by Region's Representative and/or Consultant.
 - .6 If instruments installed in Contract will be used for Cx of TAB and PV, then submit TAB and PV instrument calibration certificates for review and acceptance.
 - .7 Submit EMCS sensor calibration certificates.
 - .2 Commissioning Schedule:
 - .1 Create and submit detailed Cx schedule as part of construction schedule
 - .2 Allow in the schedule adequate time for Cx activities prescribed in technical specification Sections and commissioning Sections including:
 - .1 acceptance of Cx reports
 - .2 verification of reported results
 - .3 repairs, retesting, re-commissioning, and re-verification
 - .4 training
 - .3 Start-Up Documentation:
 - .1 Assemble start-up documentation and submit to Region's Representative and/or Consultant for review and acceptance before beginning commissioning.
 - .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up checklists.
 - .4 Start-up reports.
 - .5 Step-by-step description of complete start-up procedures so Region's Representative and/or Consultant can repeat start-up at any time.
 - .4 Submit for review and acceptance:
 - .1 Complete list of proposed instruments and equipment to perform commissioning.
 - .2 List data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.5 Commissioning Documentation:

- .1 Submit completed Cx documentation to Region's Representative and/or Consultant for review and acceptance.

1.5 MAINTENANCE MATERIALS SUBMITTALS

- .1 Supply and document maintenance materials, spare parts, and special tools as specified in other specification Sections.

2.0 PRODUCTS (NOT APPLICABLE)**3.0 EXECUTION (NOT APPLICABLE)****3.1 GENERAL**

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Perform Cx after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.
 - .1 Objectives: Verify that installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.
 - .3 Ensure appropriate documentation is compiled into the BMM.
 - .4 Effectively train O&M staff.
- .2 Contractor shall assist in Cx process, operating equipment and systems, troubleshooting, and making adjustments as required.
 - .1 Operate systems at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems should interact with each other as intended in accordance with Contract Documents and design criteria.
 - .2 Make adjustments as needed, during these checks, to enhance performance and meet environmental or user requirements.
- .3 Design Criteria: In accordance with Region Representative's requirements or as determined by Region's Representative and/or Consultant. To meet Project functional and operational requirements.

3.2 COMMISSIONING OVERVIEW

- .1 Include Cx as a line item in Contractor's cost breakdown.
- .2 Cx activities supplement the site quality control and testing procedures described in relevant technical specification Sections.
- .3 Conduct Cx at the same time as other activities during the construction stage.
- .4 Cx identifies issues in the Design stages, which are addressed during Construction and Cx stages. This step ensures the built [facility] meets functional and operational

requirements while operating as intended under weather, environmental and occupancy conditions. Cx activities include the transfer of critical knowledge to the Region Representative's facility operations personnel.

- .5 Region's Representative and/or Consultant will issue Interim Acceptance Certificate only after:
 - .1 Cx documentation has been received, reviewed for suitability, and reviewed and accepted by Region's Representative and/or Consultant,
 - .2 equipment, components and systems have been commissioned, and
 - .3 O&M training has been completed.

3.3 PRE-COMMISSIONING REVIEW

- .1 Before Construction:
 - .1 Review Contract Documents and confirm in writing to Region's Representative and/or Consultant the following:
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Coordinate provision, location, and installation of provisions for Cx.
- .3 Before Beginning Cx:
 - .1 Verify Cx Plan and schedules are up-to-date.
 - .2 Verify installation of related components, equipment, systems, and sub-systems are complete.
 - .3 Review Cx requirements and procedures.
 - .4 Verify documentation used for the Cx process is shelf-ready (bound, organized, indexed, etc.).
 - .5 Review design criteria and intent, and special features to ensure full understanding.
 - .6 Submit complete start-up documentation to Region's Representative and/or Consultant.
 - .7 Verify systems have been cleaned thoroughly.
 - .8 Complete TAB procedures on systems and submit TAB reports to Region's Representative and/or Consultant for review and acceptance.
 - .9 Verify "As-Built" system schematics are available.
- .4 Inform Region's Representative and/or Consultant in writing of defects and deficiencies in installed Work.

3.4 STARTING AND TESTING

- .1 Contractor to provide and pay costs of the following:
 - .1 inspections, including disassembly and re-assembly after approval, and for starting, testing, adjusting, and;
 - .2 temporary testing equipment.

3.5 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application Tolerances:
 - .1 A specified range of acceptable deviations of measured values from specified values or specified design criteria except for special areas that shall be within +/- [10]% of specified values.
- .2 Instrument Accuracy Tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement Tolerances During Verification:
 - .1 Unless otherwise specified, actual values shall be within +/- [2]% of recorded values.

3.6 MANUFACTURER SERVICES

- .1 During factory testing, manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Arrange for Region's Representative and/or Consultant to observe testing.
 - .3 Submit testing documentation for review and acceptance by Region's Representative and/or Consultant.
 - .4 Obtain written acceptance of test results and documentation from Region's Representative and/or Consultant before delivery to site.
- .2 Obtain manufacturer's installation, start-up and operations instructions before start-up of components, equipment and systems, and review with Region's Representative and/or Consultant.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures that may be detrimental to equipment performance and review with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified in other divisions or where required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.

- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 Report results in clear, concise, logical manner.

3.7 COMMISSIONING PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in a normal and safe manner before conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in the following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, reviewed and accepted shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: Follow accepted start-up procedures.
 - .3 Operational testing: Document equipment performance.
 - .4 System PV: Include repetition of tests after correcting deficiencies.
 - .5 Post-Substantial Performance Verification: To include fine-tuning.
- .3 Correct deficiencies and obtain acceptance from Region's Representative and/or Consultant after distinct phases have been completed and before beginning the next phase.
- .4 Document required tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Region's Representative and/or Consultant. If evaluation report indicates that equipment start-up procedure was deficient and resulted in equipment damage, perform the following:
 - .1 Minor equipment/systems: Perform corrective measures acceptable to Region's Representative and/or Consultant.
 - .2 Major equipment/systems: If evaluation report indicates that equipment damage is minor, perform corrective measures acceptable to Region's Representative and/or Consultant.
 - .3 If evaluation report indicates that major equipment damage has occurred, Region's Representative and/or Consultant will reject equipment.
 - .1 Remove rejected equipment from site and replace with new equipment.
 - .2 Perform specified start-up procedures on new equipment/systems.

3.8 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed or recommended by equipment/system manufacturer.
- .2 With manufacturer's assistance, develop written maintenance program and submit to Region's Representative and/or Consultant for review and acceptance before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

3.9 TEST RESULTS

- .1 If start-up, testing, or PV produce unacceptable results, repair, replace or repeat specified starting or PV procedures until acceptable results are achieved.
- .2 Provide labour and materials and assume costs for re-commissioning.

3.10 START OF COMMISSIONING

- .1 Notify Region's Representative and/or Consultant at least [21] days before start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

3.11 TEMPORARY INSTRUMENTS AND EQUIPMENT

- .1 Provide the following instruments and equipment as required:
 - .1 ladders
 - .2 other instruments and equipment required to complete commissioning

3.12 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 under actual or accepted simulated operating conditions, over entire operating range, and in all modes, and
 - .2 on independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 Make EMCS trending information available as supporting documentation for performance verification.

3.13 EXTENT OF VERIFICATION

- .1 Laboratory areas:
 - .1 Provide labour and instrumentation to verify up to [100]% of reported results.

.2 Elsewhere:

- .1 Provide labour and instrumentation to verify up to [30]% of reported results, unless otherwise specified in other specification Sections.
- .3 Number and location to be at discretion of Region's Representative and/or Consultant.
- .4 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, and instrumentation.
- .5 Review and repeat commissioning of systems if inconsistencies found in more than [20]% of reported results.
- .6 Perform additional commissioning until results are acceptable to Region's Representative and/or Consultant.

3.14 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with this specification Section.
 - .2 Calibration certificates have been submitted to Region's Representative and/or Consultant.
- .2 Calibrated EMCS sensors may be used to obtain performance data if sensor calibration has been completed and accepted.

3.15 PROCEDURES FOR DEFICIENCIES DISCOVERED DURING COMMISSIONING

- .1 Correct defects and deficiencies found during the Cx process. Re-verify equipment and components within the defective or deficient system to verify proper performance, including related systems if requested by Region's Representative and/or Consultant.
- .2 Costs associated with re-commissioning defective and deficient work is the responsibility of Contractor. Above costs to be in the form of progress payment reductions or hold-back assessments.

3.17 MISCELLANEOUS CHECKS AND ADJUSTING

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

3.18 DEFICIENCIES AND DEFECTS

- .1 Correct deficiencies and defects found during start-up and Cx to satisfaction of Region's Representative and/or Consultant.
- .2 Report concerns, deficiencies, and defects affecting Cx to Region's Representative and/or Consultant in writing. Stop Cx until problems are rectified. Proceed with written acceptance from Region's Representative and/or Consultant.

3.19 CLOSEOUT ACTIVITIES

- .1 Completion of Commissioning:
 - .1 Upon completion of Cx, leave systems in normal operating mode.
 - .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx before issuance of Interim Certificate of Completion.
 - .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Region's Representative and/or Consultant.
- .2 Activities Upon Completion of Commissioning:
 - .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.
- .3 Training:
 - .1 In accordance with Section 01 79 00.13 - Demonstration and Training for Building Commissioning.

END OF SECTION

1.0 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed for approval by Region's Representative.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies

deposited with, Region's Representative before final inspection.

- .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
- .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Region's Representative for approval. Submission of individual data will not be accepted unless directed by Region's Representative.

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- .2 Make changes as required and re-submit as directed by Region's Representative.
 - .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .8 Site records:
 - .1 Region's Representative will provide one (1) set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducible, revising reproducible to show work as actually installed.
 - .3 Use different colour for each service.
 - .4 Make available for reference purposes and inspection.
 - .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Region's Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible built drawings with Operating and Maintenance Manuals.
 - .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 43 00 – Quality Assurance.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Ontario Health and Safety standards.

1.4 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

2.0 PRODUCTS

2.1 MATERIALS

- .1 All materials used on this project shall be new and CSA approved unless noted otherwise.

3.0 EXECUTION

3.1 PAINTING, REPAIRS AND RESTORATION

- .1 Do painting as needed to patch the works.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 43 00 - Quality Assurance and submit report as described in PART 1 - SUBMITTALS.
 - .1 Perform tests as specified in other sections of this specification.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Region's Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-

shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Region's Representative may record these demonstrations on video tape for future reference.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 This Section includes requirements for selective demolition and removal of plumbing, sprinkler systems and related mechanical components and incidentals required to complete work described in this Section ready for new construction.

1.2 REFERENCES

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

1.3 DEFINITIONS

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

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.
- .2 Scheduling:
 - .1 Account for Region Representative's continued occupancy requirements during selective demolition and schedule staged occupancy and worksite activities Region's Representative.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work of this Section in accordance with:
 - .1 Provincial/Territorial Workers' Compensation Boards/Commissions.
 - .2 Provincial/Territorial Occupational Health and Safety Standards and Programs.

1.7 SITE CONDITIONS

- .1 Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.
- .2 Discovery of Hazardous Substances:
 - .1 It is not expected that Hazardous Substances will be encountered in the Work. Immediately notify Region's Representative if materials suspected of containing hazardous substances are encountered.
- .3 Hazardous Substances:
 - .1 Hazardous Substances are present in building to be selectively demolished. A report on the presence of Hazardous Substances is attached as an information document to this Specification for review and use. Examine report to become aware of locations where hazardous materials are present. Coordinate removal of hazardous materials as per appropriate sections of this specification.

1.8 SALVAGE AND DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain the Region Representative's property.

- .2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of.
 - .1 Leave main electrical distribution panel in place; panel can be used for temporary construction power for this and subsequent contracts in coordinate temporary power connections with Region's Representative.
 - .2 Leave main telephone terminal backboard in place; panel can be used for temporary construction telephone system for this and subsequent contracts coordinate temporary telephone connections with Region's Representative.

2.0 PRODUCTS

2.1 MATERIALS

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

3.0 EXECUTION

3.1 EXAMINATION

- .1 Verification of Existing Conditions:
 - .1 Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before tendering the Bid.
 - .2 Region's Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit.
- .2 Identify on-site removal of walls and ceilings required to facilitate work.
- .3 Identify on-site testing of piping to facilitate work.
- .4 Identify risks from hazardous materials prior to commencing work.

- .5 Ensure hazardous materials are removed or abated prior to commencing demolition.
- .6 For components intended to for relocation and reuse; remove, protect, store, clean, reinstall and connect to plumbing system. Recommission.

3.2 PREPARATION

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

3.3 EXECUTION

- .1 Coordinate requirements of this Section with information contained and as follows:
 - .1 Disconnect and cap mechanical services in accordance with requirements of local Authority Having Jurisdiction.
 - .2 Do not disrupt active or energized utilities without approval of the Region's Representative.

- .3 Erect and maintain dust proof and weather tight partitions to prevent the spread of dust and fumes to occupied building areas; remove partitions when complete.
- .4 Demolish parts of existing building to accommodate new construction and remedial work as indicated.
- .5 At end of each work day, leave worksite in safe condition.
- .6 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove tools or equipment after completion of work and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
- .7 Medical gas demolition must be coordinated with the Health Authority, Service Ontario, Labour Division Inspection Authority, medical gas certification agency and in accordance with CSA Z7396.1-17, Medical Gas Pipe Line Systems – Part 1.
- .8 Conduit demolition of plumbing systems in accordance with local Authorities Having Jurisdiction (AHJ's) including Service Ontario, Labour Division Inspection Authority and city plumbing inspection authority.

3.4 CLOSEOUT ACTIVITIES

- .1 Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re-use in new construction.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

- .1 Materials and installation for plumbing specialties and accessories.**

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.**
- .2 Section 01 43 00 – Quality Assurance.**
- .3 Section 01 74 19 –Construction Waste Management and Disposal.**
- .4 Section 01 78 00 – Closeout Submittals.**
- .5 Section 01 91 13 – General Commissioning (Cx) Requirements.**

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)**
 - .1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.**
 - .2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.**
- .2 American National Standards Institute (ANSI)**
 - .1 ANSI Z358.1 Emergency eyewash and shower equipment.**
- .3 Canadian Standards Association (CSA)**
 - .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.**
 - .2 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.**
- .4 Health Canada/Workplace Hazardous Materials Information Systems (WHMIS).**
 - .1 Safety Data Sheets (SDS).**
- .5 Plumbing and Drainage Institute (PDI)**
 - .1 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.**

- .2 PDI-WH201, Water Hammer Arresters Standard.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
 - .2 Indicate dimensions, construction details and materials for specified items.
 - .3 Submit WHMIS SDS in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's for adhesive and solvents during application and curing.
- .3 Shop Drawings:
 - .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals. Include:
 - .1 Description of plumbing specialties and accessories, giving manufacturer's name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.5 QUALITY ASSURANCE

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.

- .3 Co-ordination with other building subtrades.
- .4 Review manufacturer's installation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging materials in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Divert unused metal materials from landfill to metal recycling facility as approved by Region's Representative.
 - .5 Fold up metal and plastic banding flatten and place in designated area for recycling.

1.7 WARRANTY

- .1 Provide a written guarantee, signed and issued in the name of the Region's Representative, against defective materials and workmanship for a period of one (1) years from the date of Substantial Completion.

2.0 PRODUCTS

2.1 CLEANOUTS

- .1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access covers:
 - .1 Wall access: face or wall type, or stainless steel square cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
 - .2 Floor access: round cast iron body and frame with adjustable secured nickel bronze top.
 - .1 Plugs: bronze with neoprene gasket.

- .2 Cover for unfinished concrete floors: cast iron round, gasket, vandal-proof screws.
- .3 Cover for terrazzo finish: polished nickel bronze brass with recessed cover for filling with terrazzo, vandal-proof locking screws.
- .4 Cover for tile and linoleum floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
- .5 Cover for carpeted floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.2 STRAINERS

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS2 and under, bronze body, screwed ends, with brass cap, tapped blowoff and plug.
- .3 NPS2½ and over, cast iron body, flanged ends, with bolted cap, tapped blow off connection with bronze ball valve.

2.3 ACID NEUTRALIZATION DEVICES

- .1 Chemical dilution tank:
 - .1 Chemical neutralization tanks to be constructed of seamless natural linear low density polyethylene resins. Tank to have uniform wall thickness and be free of any stresses.
 - .2 Tanks to be provided complete with side inlet/outlet connections.
 - .3 Tanks to be supplied with side plumbing vent connection.
 - .4 Each tank inlet/outlet to accept connection to corrosion resistant drainage piping system utilizing threaded male adaptor and mechanical joint connections.
 - .5 Tanks to be provided with bolted cover complete with vapour tight cover gasket pre-cut to cover bolt hole pattern.
 - .6 Connections: as indicated.
 - .7 Size (total volume, not effective volume):
 - .1 As indicated.

- .8 Neutralization tank overall height and diameter to be as follows:
 - .1 As indicated.
- .9 Neutralization tank inlet/outlet location on tank will be field determined by Contractor after rough-in of chemical resistant waste piping.
- .2 Chemical neutralization tank sediment interceptor:
 - .1 Chemical neutralization tank sediment interceptors to be constructed of seamless natural linear low density polyethylene resins. Tanks to have uniform thickness and be free of any stresses.
 - .2 Tanks to be provided complete with side inlet/outlet connections.
 - .3 Tanks to be supplied without plumbing vent connection.
 - .4 Each tank inlet/outlet to accept connection to corrosion resistant drainage piping system utilizing male threaded adaptor and mechanical joint connections.
 - .5 Tanks to be provided complete with bolted cover complete with vapour tight cover gasket pre-cut to cover bolt hole pattern.
 - .6 Connections: as indicated.
 - .7 Sizes (total tank volume, not solids retained in basket):
 - .1 Capacity: as indicated.
 - .8 Sediment interceptor overall height and diameter as indicated.
 - .9 Sediment interceptor inlet/outlet location on tank wall to be field determined by Contractor after rough-in of chemical resistant waste piping.
 - .10 Sediment interceptor to be fully recessed in pre-formed concrete pit constructed by the General Contractor. The General Contractor is to be responsible to supply cover over pit to accommodate pedestrian traffic.
 - .11 Sediment interceptor solids baskets shall consist of a perforated polyethylene liner with 4.7 mm diameter perforations.
 - .12 The General Contractor to be responsible to fabricate and install steel frame structure to support sediment interceptor if required to facilitate connection to neutralization tank at proper invert.

2.4 POTABLE WATER THERMAL EXPANSION TANK

- .1 Quantity: as indicated.
- .2 Application: absorb expanded water from domestic hot water tanks because of the inability to expand back into the Town potable water system due to the presence of a backflow preventer on the incoming water supply to the building.
- .3 ASME Section VIII construction and label.
- .4 FDA approved butyl bladder.
- .5 1NPT stainless steel system connection.
- .6 Standard tire air charging valve connection.
- .7 1033 kPa maximum working pressure.
- .8 Vertical tank, floor mounted.
- .9 Dimensions: as indicated.
- .10 Tank volume: as indicated.
- .11 Acceptance volume: as indicated.
- .12 Red primer exterior finish.
- .13 Air pre-charge to be adjusted in field by the Mechanical Contractor to equal the residual cold water pressure on the discharge side of the pressure reducing valve on the domestic water service entrance by the Mechanical Contractor.

3.0 EXECUTION**3.1 MANUFACTURER'S INSTRUCTIONS**

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

3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

- .1 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.4 STRAINERS

- .1 Install with sufficient room to remove basket.

3.5 START-UP AND COMMISSIONING

- .1 General:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: supplemented as specified herein.
- .2 Timing: Start-up only after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Water treatment systems operational.
- .3 Provide continuous supervision during start-up.

3.6 TESTING AND ADJUSTING

- .1 General:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: supplemented as specified herein.
- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:
 - .1 Pressure at fixtures: +/- 70 kPa.
 - .2 Flow rate at fixtures: +/- 20%.

-
- .4 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
 - .5 Access doors:
 - .1 Verify size and location relative to items to be accessed.
 - .6 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.
 - .7 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.
 - .8 Hydronic system water Make-up Assembly:
 - .1 Verify operation.
 - .9 Commissioning Reports:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: supplemented as specified herein.
 - .10 Training:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: supplemented as specified herein.
 - .2 Demonstrate full compliance with Design Criteria.

END OF SECTION

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Building Systems Upgrade – HVAC, LED and Nursing Call, 2387 Industrial St, Burlington

Section 220529
Hangers and
Supports for
Plumbing Piping &
Equipment**1.0 GENERAL****1.1 RELATED WORK**

- .1 This Specification Section forms part of Contract Documents and is to be read, interpreted, and coordinated with other parts.

1.2 SCOPE OF WORK

- .1 Refer to Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment. Comply with requirements of Section as related to general requirements, products and execution.
 - .1 Acceptable Products: Hubbard Enterprises – Holdrite Systems.
- .2 In addition to piping, equipment and systems listed, provide hangers and supports complying with requirements of Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment on plumbing piping and equipment including:
 - .1 Domestic cold water
 - .2 Domestic hot water and recirculation.
 - .3 Natural gas.

END OF SECTION

1.0 GENERAL

1.1 RELATED WORK

- .1 This Specification Section forms part of Contract Documents and is to be read, interpreted, and coordinated with other parts.

1.2 SCOPE OF WORK

- .1 Refer to Section 23 05 53 - Identification for HVAC Piping & Equipment. Comply with requirements of Section as related to general requirements, products and execution.
- .2 In addition to piping, equipment and systems listed in Section 23 05 53 – Identification for HVAC Piping and Equipment, provide identification on plumbing piping, valves and equipment, including the following:
 - .1 Domestic cold water
 - .2 Domestic hot water
 - .3 Sanitary waste and venting.
 - .4 Storm drainage.
 - .5 Natural gas.

END OF SECTION

1. GENERAL

1.1. WORK INCLUDED

- .1 Sample of a Test Verification Sheet is provide at the end of the section and this sheet or a similar one with all pertinent information is to be filled out for all tests called for in the Specification or required by code. The sheets shall be signed by the Contractor and the Independent Company to verify that the data recorded is correct.
- .2 Leakage tests shall be carried out on sections of the work and these sections shall be identified by reference number of the test sheet and by description of the duct system. The reference identification number shall be indicated on the As-Build Drawings.
- .3 The following systems shall be tested and balanced:
 - .1 Boilers and heating systems
 - .2 Water treatment systems
 - .3 Plumbing systems
 - .4 All process piping including gas, air nitrogen and vacuum
- .4 The Contractor shall provide a schedule for all testing and balancing.

1.2. QUALITY ASSURANCE

- .1 The balancing of the water and air systems shall be performed by the same balancing company.
- .2 Balancing companies shall be members of A.A.B.C. or N.E.B.B.
- .3 Acceptable balancing companies are limited to the following:
 - .1 Design Test
 - .2 Pro-Air Testing
 - .3 VPG Associates
 - .4 Airwaso
 - .5 Leslie Danhart Inc.
 - .6 Air Audit
 - .7 Dynamic Flow Balancing Ltd.
 - .8 Vital Canada Group Inc.

2. PRODUCTS

2.1. NOT USED

3. EXECUTION

3.1. THE CONTRACTORS TESTING AND BALANCING

- .1 Test all plumbing systems in accordance with all applicable plumbing codes.
- .2 Compressed air and nitrogen systems shall be tested to a minimum of 150 psig and shall be proven tight over a period of 24 hours.
- .3 Test for vacuum shall be 1-1/2 times the operating vacuum.
- .4 All other systems not covered by codes noted above shall be tested and proven tight over a period of 24 hours by a hydrostatic test. Remove vents and gauges and temporarily plug connections.
- .5 Test pressure for steam and water systems shall be:
 - .1 1-1/2 times the system working pressure but not less than 1035 kPa (150 psig)
OR The maximum working pressure of expansion joints and vibration isolators.
 - .2 Repair any leaks or defects and repeat the tests to the satisfaction of the Engineer's Representative.
- .6 After completion of the testing, rough balance the water systems and ensure all coils, convertors, etc., are operating to approximately design conditions to ensure freezing conditions will not occur anywhere. Adjust the circuits by means of balancing valves.
- .7 Where multiple branch domestic hot recirculation or drinking fountain chilled water lines are installed, the flow in these shall be balanced to ensure hot or chilled water, as applicable, at all fixtures.
- .8 Balance on water lines shall be obtained by inserting thermometers between the pipe and insulation of the various return lines and adjusting flow until all thermometers read the same appropriate system temperature.
- .9 Balance on water lines shall be obtained by inserting thermometers in thermometer wells provided for this purpose at each balancing valve and adjusting flow until all thermometers read the same appropriate system temperature.

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- .10 All tests for systems shall be performed in the presence of, and test reports signed by, the Independent Company. Notify the Independent Company in writing a minimum of one week in advance of testing.
 - .11 Co-ordinate with the Independent Company to ensure all necessary valves for balancing the system is installed.
 - .1 Notify the Consultant in writing that this co-ordination has taken place before installation begins. If this Contractor fails to co-ordinate with the Independent Company and if failure to co-ordinate results in being unable to balance the systems, the cost of any changes required shall be paid for by the Contractor at no cost to the Region's Representative.
 - .12 Ensure that all cooling coil drain pans drain freely and that no standing water remains.
 - .13 Ensure access is provided to all valves and equipment that requires servicing.
 - .14 The Contractor is responsible for all equipment operating to design conditions and shall trim impellers, etc., to provide the required conditions, but is not responsible for balancing the system.
 - .15 The Contractor shall make available staff, as required by the Independent Company, to correct any deficiencies in the mechanical systems which prevent the Independent Company from balancing the system.
 - .16 The Contractor shall provide copies of all Shop Drawings requested by the Independent Company.
 - .17 The Contractor referred to is the prime Mechanical Contractor.

3.2. THE INDEPENDENT COMPANY'S TESTING AND BALANCING

- .1 The Consultant in consultation with the Mechanical Contractor, shall appoint an Independent Company to measure and report to the Consultant. The Independent Company shall submit a proposal to the Consultant for assessment before any selection is made. The proposal shall include:
 - .1 Experience in projects of this size
 - .2 Labor costs per hour plus a maximum upset limit
 - .3 Personnel to be used
 - .4 Equipment to be used for the testing and balancing of the systems
 - .5 Test procedures and methods
 - .6 Any other items requested

-
- .2 The Independent Company shall balance the entire water system to ensure all heat exchangers, etc., are operating to design conditions. Adjust the circuits by means of the balancing valves and record balance position.
 - .3 Each pump shall be checked for design, working and shut-off head conditions and any pump that varies by more than 10% from the design conditions shall have the impeller trimmed until design conditions have been met.
 - .4 Flow through all heat exchangers, chillers, boilers and other such equipment shall be balanced to ensure that the pressure drop through the equipment is within 10% of the manufacturer's design conditions.
 - .1 If the design conditions cannot be met by adjusting the balancing valves throughout the system, then pump impellers shall be either changed or trimmed as required.
 - .5 Initial balancing of coils shall be to ensure that the pressure drops are within 10% of the manufacturers design conditions. When both the air and water systems are fully operational entering air and water and leaving air and water readings shall be taken as close as possible to the peak design conditions to ensure the coil performance meets the design conditions. Coil water working conditions shall only be taken in conjunction with the air flow working conditions for the coil.
 - .6 Adjust bleed-off from cooling tower, evaporative condensers, spraycoils and similar equipment to prevent lime deposits. Record bleed- off rate.
 - .7 The Independent Company shall not disconnect any control device. Furnish a list of adjusted set points. Commanding of control valves and entering of adjusted set points into the building automation system for testing and balancing purposes is performed. If the Independent Company fails to co- ordinate and if failure to co- ordinate results in any cost, the cost of any change required shall be paid by the Independent Company at no cost to the Region's Representative.
 - .8 The Independent Company shall witness all system tests and sign all test reports. Include one copy of all test reports in each copy of the balancing reports.
 - .9 Co-ordinate with the Contractor to ensure that all necessary valves for control and balancing are installed in all locations required. Notify the Consultant in writing that this co-ordination has taken place. Include in this letter any recommendations made regarding valves, locations, installations, etc. If this Independent Company fails to co-ordinate with the Contractor and if failure to co-ordinate results in being unable to balance the systems, the cost of any changes required shall be paid for by the Independent Company at no cost to the Region's Representative.
 - .10 The Independent Company is responsible for balancing the systems to obtain the design conditions, and shall repeat the balancing until the required conditions have been met.
 - .11 At the time of final inspection, recheck in the presence of the Consultant random

selections of data recorded in the certified report. Points or areas for recheck shall be selected by the Consultant and be approximately 10% of the report data.

- .12 A measured deviation of more than 10% between the verification adding and the reported data shall be considered as failing the verification procedure.
- .13 A failure of more than 10% of the selected verification readings shall result in rejection of the report as unacceptable.
- .14 In the event the report is rejected, rebalance all systems, submit new certified reports and make a re-inspection, all at no additional cost to the Region's Representative.
- .15 Following final acceptance of the certified reports by the Engineer's Representative, permanently mark the settings of all valves and other adjustable devices so that balance set position can be restored if disturbed at any time. For circuit balancing valves, record the valve position by the number of turns registered on the valve and lock the valve into that position. Do not mark such devices until after final acceptance.
- .16 Provide 3 copies of the final testing and balancing reports. Reports shall be complete with index pages and index tabs, and certified by the Independent Company. All diagrams as single line representation of a Mechanical system specifically prepared for this project shall be prepared using a CAD system and shall be acceptable to Consultant.

T-734-26

Building Systems Upgrade – HVAC, LED and Nursing Call, 2387 Industrial St, Burlington

Section 220593.13
Testing and Balancing
System**TEST VERIFICATION SHEET- PIPING**

Test Number:

Date

System:

Description and sketch of tested component

Starting test pressure

Starting test temperature

Final test pressure

Finish test Temperature

Duration of test

Test performed by: (signature)
(signature)

Verified by:

(Printed name)

(Printed name)

(Company)

Test witnessed by: (signature)

Test witnessed by: (signature)

(Printed name)

(Printed name)

(Company)

(Company)

END OF SECTION

1.0 GENERAL

1.1 Product data

- .1 Submit product data sheets for valves.

2.0 PRODUCTS

2.1 Domestic hot, cold, tempered, and recirculating piping, within building:

- .1 All copper water tubing to bear certification markings indicating compliance with the Plumbing Code. Certification markings on the tubing may be made by a testing agency accredited for that purpose by the Standards Council of Canada.
- .2 Copper tube, hard drawn, type L to ASTM B88M-85 CSA HC-66 above ground.
- .3 Boosted pressure water risers to be roll grooved copper.

2.2 Fittings

- .1 Brass or bronze flanges and flanged fittings to ANSI B16.24-1979.
- .2 Brass or bronze threaded fittings to ANSI B16.15-1978.
- .3 Cast bronze to ANSI B16.18-1984 CSA B158 or wrought copper and bronze to ANSI B16.22-1980 CSA B158.
- .4 Roll groove full flow standard radius cast bronze for sizes NPS 2 1/2 to 6 to ANSI AWWA C606.

2.3 Joints

- .1 Flanged joints to be made up with
 - .1 Rubber gaskets 1.6 mm (1/16 in) thick to ANSI A21.11-1980 or AWWA C111-80.
 - .2 Bolts and nuts to be heavy series, hexagonal head pattern with washers to ASTM A307- 83a.
- .2 Copper to copper couplings to be made up with
 - .1 Tin antimony brazing filler, 95:5 to ASTM B-32-83.
 - .2 Silver brazing alloy
- .3 Roll groove joints to be made up with roll groove positive clamp gasketed couplings or roll groove flange adapters for copper piping to ANSI AWWA C606. All joints NPS3 and over to be made with roll ground joints.

2.4 Gate valves

- .1 Up to NPS 3, brazed : Non-rising stem to MSS SP-80 Type 1, class 125, bronze body, screw-in or bolted bonnet.
- .2 Up to NPS 3, brazed : Rising stem to MSS SP-80 Type 2, class 125, bronze body, screw-in or bolted bonnet.
- .3 Up to NPS 3, threaded: Rising stem to MSS SP-80, class 150, bronze body, solid wedge disc. NPS 2 1/2 and over, flanged, in mechanical rooms. Rising stem: To MSS SP-70, class 125, FF flange, cast iron body, bronze trim, solid wedge disc, bolted bonnet, OS&Y.

2.5 Globe valves

- .1 NPS 3 and under, brazed
 - .1 Rising stem to MSS SP-80, class 125, bronze body, renewable composition disc, union bonnet.
 - .2 Lock shield handles as indicated.
- .2 NPS 3 and under, threaded
 - .1 Rising stem to MSS SP-80, class 150, bronze body, renewable composition disk, union bonnet.
 - .2 Lock shield handles as indicated.

2.6 Butterfly valves for working pressures up to 300 psi for grooved end pipe, with CRN. (Not to be used for main incoming domestic water service shutoff valve).

- .1 NPS 2 1/2 and over
 - .1 ANSI/NSF 61 classified, Class 150 long neck design, malleable or ductile iron body, aluminum bronze disk, EPDM Grade "E" liner for 93°C (200°F) working temperature. Lever handle up to NPS 3 and gear operators NPS 4 and over.

2.7 Swing check valves for working pressures up to 150 psi.

- .1 Up to NPS 3, brazed
 - .1 To MSS SP-80, class 125, Y-pattern bronze body, bronze wing disc, integral seat, screw-in cap.
- .2 Up to NPS 3, threaded
 - .1 To MSS SP-80, class 125, Y-pattern bronze body, bronze swing disc, integral seat, screw-in cap.

.3 NPS 2 1/2 and over, flanged

- To MSS SP-70, class 125, cast iron body, flat faced flange, bolted cover, renewable bronze seat ring, and bronze swing disc.

2.8 Ball valves for working pressures up to 300 psi.**.1 Up to NPS 2, brazed**

- .1 Minimum 400 psi WOG, two-piece bronze or brass body, full port stainless steel or chrome plated bronze ball, PTFE seat and seals, blowout proof stem.

.2 Up to NPS 2, threaded

- .1 Minimum 400 psi WOG, two-piece bronze or brass body, full port stainless steel or chrome plated bronze ball, PTFE seat and seals, blowout proof stem.

2.9 Drain valves**.1 On mains NPS 4 and under**

- .1 NPS 3/4 screwed ball valve of appropriate pressure rating with hose thread, cap and chain.

.2 On mains NPS 5 and over

- .1 NPS 1 1/4 screwed ball valve of appropriate pressure rating with hose thread, cap and chain. Double regulating valves (DRV)

.3 NPS 2 and under, threaded; for working pressure up to 240 psi

- .1 Bronze body, rising stem, screwed bonnet, parabolic slotted regulating disk, flow measurement ports and tamper-proof setting.

.4 NPS 2 and under, sweat end; for working pressure up to 175 psi

- .1 Bronze body, rising stem, screwed bonnet, parabolic slotted regulating disk, flow measurement ports and tamper-proof setting.

3.0 EXECUTION**3.1 Installation**

- .1 Connect to fixtures and equipment.
- .2 Isolate equipment, fixtures and branches with gate valves.
- .3 Install piping close to building structure to minimize furring and conserve headroom. Group piping and run parallel to walls.

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- .4 Lay buried tubing in accordance with AWWA Class "B" bedding.
 - .5 Cut square, ream and clean tubing and tube ends.
 - .6 Prepare roll groove joints using shop or field rolled grooves and provide anchors, guides and supports in accordance with coupling manufacturer's instructions.
 - .7 Clean inside of brazing fittings and outside of mating pipe with emery paper and coat with flux.
 - .8 Braze joints with a blow torch or oxy-acetylene flame using a single or double tip torch, depending on fitting size.
 - .9 Use silver brazing filler made up of 95% tin and 5% antimony for pipe up to and including NPS 3 in.
 - .10 Use silver brazing alloy for pipe NPS 4 and over, and on every size of underground copper piping.
 - .11 Remove working parts of valves during brazing.
 - .12 Balance recirculation system using lock shield globe valves.
 - .13 Supply chemicals and provide temporary tanks, piping and pumping equipment and disinfect potable water systems before use.

END OF SECTION

1.0 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .4 Section 23 05 53.01 – Mechanical Identification.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1 SI, Energy Standard for Buildings except Low-Rise Residential Buildings.
- .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - .2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M, Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533, Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
 - .7 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .8 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .9 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

- .10 ASTM C921, Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CGSB 51-GP-53M, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .4 Thermal Insulation Association of Canada (TIAC)
 - .1 National Insulation Standards.
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .6 Model National Energy Code of Canada for Buildings (MNECB).

1.3 PRODUCT DATA

- .1 Submit Product Data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Submit manufacturer's installation instructions in accordance with 01 33 00 - Submittal Procedures.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.6 QUALIFICATIONS

- .1 Installer to be certified in performing work of this section, and have at least five (5) years successful experience in this size and type of project, qualified to standards of TIAC.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions recommended by manufacturer.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by Region's Representative.
- .5 Divert unused adhesive materials from landfill to official hazardous material collections site approved by Region's Representative.
- .6 Do not dispose of unused adhesive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

2.0 PRODUCTS

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre: includes glass fibre, rock wool, slag wool.

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- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24° C mean temperature when tested in accordance with ASTM C335.
 - .3 TIAC Code A-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: ASTM C547.
 - .2 Maximum "k" factor: ASTM C547.
 - .4 TIAC Code A-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
 - .1 Insulation: ASTM C533.
 - .2 Maximum "k" factor: ASTM C533.
 - .3 Design to permit periodic removal and re-installation
 - .5 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: ASTM C547.
 - .6 TIAC Code A-6: Flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket to ASTM C534.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: C534.
 - .4 Certified by manufacturer free of potential stress corrosion cracking corrodants.
 - .5 Flame spread index less than 25, and smoke developed index less than 50.
 - .7 TIAC Code C-1: Rigid mineral fibre board, unfaced.
 - .1 Mineral fibre: ASTM C612.
 - .2 Maximum "k" factor: ASTM C612.

- .8 TIAC Code C-2: Mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: ASTM C553.
- .9 TIAC Code C-4: Rigid mineral fibre board faced with factory applied vapour retarder jacket.
 - .1 Mineral fibre: ASTM C612.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: ASTM C612.

2.3 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CGSB 51-GP-53M with pre-formed shapes as required.
 - .2 Colours: to match adjacent finish paint. Confirm with Region's Representative.
 - .3 Minimum service temperatures: -20° C.
 - .4 Maximum service temperature: 65° C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.56 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements:
 - .1 Indoor: flame spread rating 25. Smoke developed 50.
 - .2 Outdoor: UV rated material at least 0.5 mm thick.

- .9 Covering adhesive: Compatible with insulation.
- .2 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: Compatible with insulation.

2.4 REMOVABLE INSULATION COVERS

- .1 General:
 - .1 All Covers shall be sewn, stapled or” hog-ringed” covers shall not be acceptable.
 - .2 Covers shall conform to the configuration of the items being insulated.
 - .3 Covers shall include openings for all protrusions such as pipes, packing glands on valves and expansion joints, hangers, supports, instrument lines, and other appurtenances.
 - .4 Covers shall be designed so that no force bending or folding of the cover is necessary for installation.
 - .5 Minimum 50mm wide flaps at terminal ends are to be provided to overlap adjacent covers to ensure a good heat seal.
 - .6 Parting seems shall be at the installed low points (gravitational bottom) of the cover to allow drainage without the use of weep tubes or grommets.
 - .7 Valve bonnets are to be covered, but packing glands shall remain exposed.
 - .8 Valve covers are to be designed such that the bonnet section is sewn to the body section. For larger valves, the cover may be fabricated in two sections, each section containing one half of the valve body and bonnet.
 - .9 Covers with a weight of 18.1 Kg or less are to be fabricated in one piece.
 - .10 Covers with a weight of more than 18.1 Kg are to be fabricated in more than one piece.
- .2 Insulation Core:
 - .1 The insulation core shall be fabricated in one piece, wherever possible.
 - .2 To prevent insulation settlement, the insulation core shall be secured

within the jacket through the weather barrier (outer jacketing), the insulation, and the liner (inner jacketing).

- .3 Insulating cores with more than one piece shall have staggered joints to prevent hot spots and heat loss. The joint edges shall be butted together and extra securement provided at those edges.
- .4 Insulation core shall be comprised of 50mm thick fiberglass insulation of non-combustible wool with resilient inorganic glass fibers bonded with a thermosetting resin. Insulation density to be 38 Kg/m³. Insulation thermal conductivity to be 0.044W/m.° C at a mean temperature of 100° C.
- .3 Jacket:
 - .1 The jacket shall be fabricated in one piece, wherever possible.
 - .2 Gusset walls shall be required for covers with core insulation thickness in excess of 25mm.
 - .3 All seams, except the final closing seam, shall be inside seams. The jackets are to be sewn inside out, then turned correct side out before inserting the insulation core. The final closing seam shall be sewn on the exterior of the jacket. Seams shall be sewn with Teflon® coated fiberglass thread or Kevlar® coated stainless steel thread.
 - .4 Machine stitching shall be used for all sewing. Sewing shall be 6-8 stitches per centimeter.
 - .5 Draw cords are to be placed along the outer edge of the flap and the outer edge of the flap then rolled back inside and double stitched.
 - .6 Draw cords are to be of sufficient length to allow 150mm of cord to protrude from each side of the flap.
 - .7 The inner and outer jacket shall be comprised of a fiberglass fabric impregnated with silicone rubber. The silicone rubber shall be flame retardant and suitable for high temperature usage. Outer jacket density shall be 595 gms/m².
- .4 Securement devices:
 - .1 The securement belts and D-ring belts shall be of the same material as the weather barrier (exterior jacket).
 - .2 The belts shall be placed 50mm back from the parting seams and on 150mm centers.

- .3 Fire retardant Velcro® shall be used to fasten the securement belt to the weather barrier after the belt passed through the Stainless Steel D-rings.
- .5 Identification tags:
 - .1 Each cover shall be identified by a permanently attached stainless steel tag.
 - .2 An identification legend shall be mechanically embossed into the tag.
 - .3 The tags shall be located in the same areas on similar type covers.
 - .4 Should a cover require more than one piece for its construction, each piece to be identified and numbered (i.e. 1 of 3).
 - .5 Each tag shall include at least the following information, but may also include any pertinent information required by the end user.
 - .1 Type of item being covered.
 - .2 Location of item.
 - .3 Recording and tracking information.
 - .6 Warranty:
 - .1 Provide a 5-year product Warranty

2.5 INSULATION SECUREMENTS

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.
- .6 Facing: 25 mm galvanized steel hexagonal wire mesh on one face of insulation.
- .7 Fasteners: 4 mm diameter pins with 35 mm diameter or square clips. Length of pin to suit thickness of insulation.

2.6 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

2.8 OUTDOOR VAPOUR RETARDER MASTIC

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

3.0 EXECUTION

3.1 PRE- INSTALLATION REQUIREMENTS

- .1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

- .1 Install in accordance with TIAC National Standards
 - .1 Hot equipment: To TIAC code 1503-H.
 - .2 Cold equipment: to TIAC code 1503-C or 1503-CA.
- .2 Elastomeric Insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.
- .3 Provide vapour retarder as recommended by manufacturer.
- .4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.
- .5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports outside vapour retarder jacket.

.7 Supports, Hangers:

- .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 EQUIPMENT INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 Hot Equipment:

- .1 TIAC code A-1 or C-1 with mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.
- .2 TIAC code A-2 with 25 mm air gap, mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.
- .3 TIAC code C-2 unfaced with wire or bands and 13 mm cement preceded by one layer of reinforcing mesh.
- .4 Thicknesses:
 - .1 Domestic hot water storage tanks 25 mm
 - .2 Shell and tube heat exchangers 50 mm
 - .3 Steam condensate receivers 50 mm
 - .4 Deaerator-feedwater heaters 50 mm
 - .5 Chilled and hot water buffer tanks

.3 Breechings, engine exhausts and mufflers:

- .1 TIAC code A-2 with 25 mm air gap, mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.
- .2 Cement reinforced with one layer of reinforcing mesh.

.4 Cold equipment:

- .1 TIAC A-3 or C-4 with mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.
- .2 TIAC C-2 faced with vapour retardant jacket and with wire or bands and 13 mm cement preceded by one layer of reinforcing mesh.

- .3 TIAC A-6 or C-4 with mechanical fastenings or wire or bands, adhesive.
- .1 Thicknesses: Chillers (except factory insulated) 50 mm A-3, A-6 or C-4.
- .5 Finishes:
 - .1 Engine exhaust piping and muffler: To TIAC code CEF-4.
 - .2 Equipment in mechanical rooms: TIAC code CEF/1 with aluminum jacket.
 - .3 Equipment elsewhere: TIAC code CEF/2 with 13 mm cement and canvas jacket.

3.4 REMOVABLE INSULATION COVERS

- .1 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .2 Removable insulation covers shall be provided for the following:
 - .1 Domestic water service entrance backflow preventer.
 - .2 Domestic water service entrance pressure reducing valve assembly.
 - .3 Domestic water service entrance O.S. & Y gate valve.
 - .4 Domestic water service entrance copper connection butterfly valves NPS 2½ and larger.
 - .5 Domestic water service entrance wye –strainer.
 - .6 Domestic hot water service pump assemblies.
 - .7 Hydronic heating and chilled water system pump assemblies:-pumps, suction diffusers, triple duty valves.
 - .8 Hydronic heating and chilled water system valves NPS 2½ and larger - gate, globe and butterfly.
 - .9 Hydronic heating and chilled water system flex connections, expansion joints.
 - .10 Hydronic heating and chilled water system expansion tanks.
 - .11 Hydronic heating and chilled water system air separators.

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- .12 Hydronic heating and chilled water system plate and frame heat exchangers.
 - .13 Hydronic heating and chilled water system shell and tube heat exchangers removable heads.
 - .14 Balancing valves NPS 2½ and above.
 - .15 Two-Way Control valves NPS 2½ and larger.
 - .16 Three-Way Control valves NPS 2½ and larger.

END OF SECTION

1.0 GENERAL

1.1 RELATED DOCUMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings; submit drawings stamped and signed for approval by Region's Representative.
- .3 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Region's Representative before final inspection.

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- .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - 2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Region's Representative for approval. Submission of individual data will not be accepted unless directed by Region's Representative.
 - .2 Make changes as required and re-submit as directed by Region's Representative.

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- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .8 Site records:
 - .1 Region's Representative will provide one (1) set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducible, revising reproducible to show work as actually installed.
 - .3 Use different colour for each service.
 - .4 Make available for reference purposes and inspection.
 - .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Region's Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
 - .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 43 00 - Quality Assurance.

1.4 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One casing joint gasket for each size pump.
 - .2 One head gasket set for each heat exchanger.
 - .3 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
 - .1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

2.0 PRODUCTS**2.1 MATERIALS**

- .1 All materials used on this project shall be new and CSA approved unless noted otherwise.

3.0 EXECUTION**3.1 PAINTING, REPAIRS AND RESTORATION**

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Protect open ends of ducts, diffusers, grilles and registers during construction to prevent ingress of dust and dirt into interior of ducts. If dust or dirt is detected prior to startup, vacuum interior of all ducts and air handling units. Prior to vacuuming use video camera to

record condition of ductwork. Also use video camera to record condition of ducts after cleaning.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 43 00 - Quality Assurance and submit report as described in PART 1 - SUBMITTALS.
 - .1 Submit tests as specified in other sections of this specification.
- 2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Region's Representative will use equipment and systems for test purposes prior to acceptance.
Contractor to supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Region's Representative may record these demonstrations on video tape for future reference.

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Building Systems Upgrade – HVAC, LED and Nursing Call, 2387 Industrial St, Burlington

Section 230500
Common Work
Results for HVAC

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 **GENERAL****1.1** **SUMMARY**

- .1 Use of HVAC systems during construction.

1.2 **USE OF SYSTEMS**

- .1 Use of new and/or existing permanent heating and/or ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions: .
 - .1 Entire system is complete, pressure tested, cleaned, flushed out.
 - .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
 - .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
 - .4 There is no possibility of damage from any cause.
 - .5 Supply ventilation systems are protected by 60 % filters, which shall be inspected daily, changed every week or more frequently as required.
 - .6 Return systems have approved filters over all openings, inlets, outlets.
 - .7 All systems will be:
 - .1 operated as per manufacturer's recommendations or instructions.
 - .2 operated by Contractor.
 - .3 monitored continuously by Contractor.
 - .8 Warranties and guarantees are not thereby relaxed.
 - .9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Region Representative's Representative.
 - .10 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, and replace filters in air systems.
- .2 Filters specified in this section are over and above those specified in other sections of this project.

- .3 Exhaust systems are not included in any approvals for temporary heating ventilation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

1.0 GENERAL**1.1 SUMMARY**

- .1 Section Includes:
 - .1 Electrical motors, drives and guards for mechanical equipment and systems.
 - .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
 - .3 Control wiring and conduit specified in Division 26. Control wiring 50V or less for systems specified in Division 22, 23 is by Division 25.

1.2 RELATED SECTIONS:

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 National Energy Code for Buildings (NECB).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .4 National Electrical Manufacturers Association (NEMA).

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

-
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit drawings stamped and signed for approval by Region's Representative.
 - .3 Quality Control: in accordance with Section 01 43 00 - Quality Assurance.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Region's Representative will make available one (1) copy of systems supplier's installation instructions.
 - .4 Closeout Submittals
 - .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with Canadian Environmental Protection Act (CEPA), Canadian Environmental Assessment Agency (CEAA), Transportation of Dangerous Goods Act (TDGA) and applicable Provincial regulations.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

2.0 PRODUCTS

2.1 GENERAL

- .1 Motors to be premium efficiency, in accordance with local hydro company standards and the requirements of ASHRAE 90.1.

2.2 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 1/2 HP : speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 1/2 HP and larger: NEMA, Class B, 1.15 service factor, squirrel cage induction, premium efficiency, speed as indicated, continuous duty, enclosure as indicated, ball bearing, maximum temperature rise 40° C, 3 phase, 575 V, unless otherwise indicated, for inverted duty for variable frequency drives.

2.3 TEMPORARY MOTORS

- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Region's Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

- .3 For motors under 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 10 HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave to be determined during commissioning.
- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.
- .8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 – Closeout Submittals.

2.5 DRIVE GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives;
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm dia holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Fasten securely in place.
- .2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 43 00 - Quality Assurance and submit report as described in PART 1 - SUBMITTALS.
- .1 As specified in other sections of this specification.
- .2 Manufacturer's Field Services:
- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 74 00 – Cleaning
- .2 Section 01 74 19 – Construction Waste Management and Disposal
- .3 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by Region's Representative.

1.3 QUALITY ASSURANCE

- .1 Installers to be certified journeyperson.

2.0 PRODUCTS (NOT USED)

3.0 EXECUTION

3.1 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
 - .1 Unions are not required in installations using grooved mechanical couplings (The couplings shall serve as unions).

- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.
- .4 The flexible type grooved joint couplings may be used in lieu of a flexible connector at equipment connections for vibration attenuation and stress relief. Couplings shall be placed in close proximity to the source of the vibration, as per manufacturer's recommendations.

3.2 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

- .1 Install automatic air vents at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC WATERWAY FITTINGS AND COUPLINGS

- .1 General: Compatible with system, to suit pressure rating of system.
- .2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: Isolating waterway fittings, unions or bronze valves.

.1 Waterway fittings shall be complete with thermoplastic liner.

.4 Over NPS 2: Isolating waterway fittings and flanges.

.1 Waterway fittings shall be complete with thermoplastic liner.

3.6 PIPEWORK INSTALLATION

.1 Installation by certified journeyperson.

.2 Screwed fittings jointed with Teflon tape or pipe dope as recommended by manufacturer.

.3 Grooved joint couplings and fittings shall be installed in accordance with the manufacturer's written installation instructions.

.1 Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer.

.2 The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

.4 Push-to-connect piping: Prepare copper tube and install in strict accordance with installation instructions. Pipe ends shall be cleaned, free from indentations, projections, burrs and foreign matter. Use a tube preparation tool as supplied by the manufacturer to clean and make installation mark. Push copper tube into fittings to installation depth mark, per installation instructions. Keep fittings free of dirt and oil.

.5 Protect openings against entry of foreign material.

.6 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.7 Assemble piping using fittings manufactured to ANSI standards.

- .8 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .9 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .10 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .11 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .12 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .13 Group piping wherever possible and as indicated.
- .14 Ream pipes, remove scale and other foreign material before assembly.
- .15 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .16 Provide for thermal expansion as indicated.
- .17 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.
 - .7 Install butterfly valves on chilled water and related condenser water systems only.
 - .8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
 - .9 Install ball valves for glycol service.

- .10 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .18 Check Valves:
 - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
 - .2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 SLEEVES

- .1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: Schedule 40 black steel pipe.
- .3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
 - .2 Other floors: Terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
 - .3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.8 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRESTOPPING

- .1 Uninsulated unheated pipes not subject to movement: No special preparation.
- .2 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation, or install per manufacturer's recommendation as specified within the associated approval.
- .3 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 00 - Cleaning supplemented as specified in relevant sections of other Divisions.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Region's Representative, 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: Test as specified in relevant sections of other sections or Divisions.
- .3 Maintain specified test pressure without loss for four (4) hours minimum unless specified for longer period of time in relevant sections of other Divisions.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

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- .5 Conduct tests in presence of Region's Representative. Work to be carried out in off hours after 5 p.m., weekends or holidays.
 - .6 Pay costs for repairs or replacement, retesting, and making good. Region's Representative to determine whether repair or replacement is appropriate.
 - .7 Insulate or conceal work only after approval and certification of tests by Region's Representative.

3.12 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Region's Representative. Work to be carried out off hours after 5 p.m., weekends or holidays.
- .2 Request written approval ten (10) working days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.
- .4 Ensure daily clean-up of existing areas.

END OF SECTION

1.0 GENERAL

1.1 RELATED DOCUMENTS

- .1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- .1 Section Includes:
 - .1 Liquid in glass thermometers.
 - .2 Thermowells.
 - .3 Dial-type pressure gauges.
 - .4 Gauge attachments.
 - .5 Pitot-tube flowmeters.

1.3 SUBMITTALS

- .1 Product Data: For each type of product indicated.
- .2 Wiring Diagrams: For power, signal, and control wiring.
- .3 Product Certificates: For each type of meter and gauge, from manufacturer.
- .4 Operation and Maintenance Data: For meters and gauges to include in operation and maintenance manuals.

2.0 PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- .1 Metal-Case, Industrial Style, Liquid-in-Glass Thermometers.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide H.O. Terrice Model BX9 Industrial thermometer or comparable product by one of the following:
 - .1 Ashcroft, Inc.
 - .2 Miljoco Corporation.

- .3 Terrice, H.O. Co.
- .4 Weiss Instruments, Inc.
- .2 Standard: ASME B40.200.
- .3 Case: Cast aluminum 9-inch (229-mm) nominal size unless otherwise indicated.
- .4 Case Form: Back angle unless otherwise indicated.
- .5 Tube: Glass with magnifying lens and blue or red organic liquid.
- .6 Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in deg F (deg C).
- .7 Window: Glass.
- .8 Stem: Brass adjustable angle, brass stem and of length to suit installation.
- .1 Design for Air-Duct Installation: With ventilated shroud.
- .2 Design for Thermowell Installation: Bare stem.
- .9 Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
- .10 Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

- .1 Thermowells:
 - .1 Standard: ASME B40.200.
 - .2 Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - .3 Material for Use with Copper Tubing: Brass.
 - .4 Material for Use with Steel Piping: Brass.
 - .5 Type: Stepped shank unless straight or tapered shank is indicated.
 - .6 External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.

- .7 Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
- .8 Bore: Diameter required to match thermometer bulb or stem.
- .9 Insertion Length: Length required to match thermometer bulb or stem.
- .10 Lagging Extension: Include on thermowells for insulated piping and tubing.
- .11 Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- .2 Heat-Transfer Medium: Mixture of graphite and glycerin.
- .3 Where wells are installed in pipe tees at turns, increase pipe size so that well does not restrict flow.

2.3 PRESSURE GAUGES

- .1 Direct-Mounted, Metal-Case, Dial-Type Pressure Gauges:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Trerice, Model 600C, B, Lead Free or comparable product by one of the following:
 - .1 Ashcroft Inc.
 - .2 Ernst Flow Industries.
 - .3 Miljoco Corporation.
 - .4 Noshok.
 - .5 Weiss Instruments, Inc.
 - .2 Standard: ASME B40.100.
 - .3 Case: Cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
 - .4 Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - .5 Match pressure connection size in first subparagraph below with gage attachment size.

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- .6 Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - .7 Movement: Mechanical, with link to pressure element and connection to pointer.
 - .8 Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
 - .9 Pointer: Dark-colored metal.
 - .10 Window: Glass.
 - .11 Ring: Stainless steel.
 - .12 Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
 - .2 Remote-Mounted, Metal-Case, Dial-Type Pressure Gauges:
 - .1 Basis-of-Design Product: Subject to compliance with requirements, provide Trerice Industrial, or comparable product by one of the following:
 - .1 Ashcroft Inc.
 - .2 Ernst Flow Industries.
 - .3 Miljoco Corporation.
 - .4 Noshok.
 - .5 Weiss Instruments, Inc.
 - .2 Standard: ASME B40.100.
 - .3 Case: Liquid-filled type; cast aluminum or drawn steel, 4-1/2-inch (114-mm), nominal diameter with back flange and holes for panel mounting.
 - .4 Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - .5 Match pressure connection size in first subparagraph below with gage attachment size.
 - .6 Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

- .7 Movement: Mechanical, with link to pressure element and connection to pointer.
- .8 Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
- .9 Pointer: Dark-colored metal.
- .10 Window: Glass.
- .11 Ring: 304 Stainless steel.
- .12 Accuracy: Grade 1A, plus or minus 1 percent full scale, ASME B40.100

2.4 GAUGE ATTACHMENTS

- .1 Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Tetric Model 872 or equal. Include extension for use on insulated piping.
- .2 Valves: Brass ball valve with stainless steel trim, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

2.5 FLOW METERS

- .1 Venturi Flowmeters:
 - .1 Basis-of-Design Product: Subject to compliance with requirements, provide Preso Meters or comparable product by one of the following:
 - .1 ABB; Instrumentation and Analytical.
 - .2 Gerand Engineering Co.
 - .3 Hyspan Precision Products, Inc.
 - .4 S. A. Armstrong Limited; Armstrong Pumps Inc.
 - .2 Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, fittings, valves, indicator, and conversion chart.
 - .3 Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
 - .4 Sensor: Venturi-type, calibrated, flow-measuring element; for installation in piping.

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- .1 Design: Differential-pressure-type measurement for water.
 - .2 Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
 - .3 Minimum Pressure Rating: 250 psig (1725 kPa).
 - .4 Minimum Temperature Rating: 250 deg F (121 deg C).
 - .5 End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 - .6 End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged or welded.
 - .7 Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.
- .5 Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- (152-mm-) diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
- .1 Scale: Gallons per minute (Liters per second).
 - .2 Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.
- .6 Portable Indicators: Hand-held, differential-pressure type, calibrated for connected flowmeter element and having two 12-foot (3.7-m) hoses, with carrying case.
- .1 Scale: Gallons per minute (Liters per second).
 - .2 Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.
- .7 Display: Shows rate of flow.
- .8 Conversion Chart: Flow rate data compatible with sensor.
- .9 Operating Instructions: Include complete instructions with each flowmeter.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- .2 Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- .3 Install thermowells with extension on insulated piping.
- .4 Fill thermowells with heat-transfer medium.
- .5 Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- .6 Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- .7 Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.
- .8 Install valve and snubber in piping for each pressure gauge for fluids (except steam).
- .9 Install flow indicators in piping systems in accessible positions for easy viewing.
- .10 Install flowmeter elements in accessible positions in piping systems.
- .11 Install permanent indicators on walls or brackets in accessible and readable positions. Install thermometers in the following locations:
 - .1 Inlet and outlet of each chiller.
 - .2 Where indicated on the Drawings.
- .12 Install pressure gauges in the following locations:
 - .1 Inlet and outlet of each boiler and chiller.
 - .2 Suction and discharge of each pump.

3.2 CONNECTIONS

- .1 Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.
- .2 Connect flowmeter-system elements to meters.

3.3 ADJUSTING

- .1 After installation, calibrate meters according to manufacturer's written instructions.
- .2 Adjust faces of meters and gauges to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- .1 Thermometers at inlets and outlets of each cooling tower and chiller shall be the following:
 - .1 Industrial Style, liquid in glass type.
- 2 Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- .1 Scale Range for Condenser Water Piping: 25 deg F to 125 deg F.

3.6 PRESSURE-GAUGE SCHEDULE

- .1 Pressure gauges at inlet and outlet of each water-cooled condenser and boiler connection shall be the following:
 - .1 Brass with bronze bourdon tube, direct-mounted, metal case.
- .2 Pressure gauges at suction and discharge of each pump shall be the following:
 - .1 Brass with bronze bourdon tube, direct-mounted, metal case.

3.7 PRESSURE-GAUGE SCALE-RANGE SCHEDULE

- .1 Scale Range for Condenser Water Piping: 30 HG to 60 psi (-100 to 400 kPa)

3.8 MANUAL FLOWMETER SCHEDULE

- .1 Flowmeters for Cooling, All Systems Piping: Venturi type.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for thermometers and pressure gauges in piping systems.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 19 – Construction Waste Management and Disposal

1.3 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B40.100, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200, Thermometers, Direct Reading and Remote Reading.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
 - .2 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings and product data.
- .3 Submit manufacturer's product data for following items:
 - .1 Thermometers
 - .2 Pressure Gauges
 - .3 Ball Valves
 - .4 Syphons
 - .5 Wells

1.5 HEALTH AND SAFETY

- .1 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.
- .2 Collect, separate and place in designated containers for reuse and recycling, paper, plastic, polystyrene, corrugated cardboard packaging, steel, metal, in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.
- .4 Place materials defined as hazardous or toxic waste in designated containers.
- .5 Ensure emptied containers are sealed, labelled and stored safely for disposal away from children.

2.0 PRODUCTS

2.1 GENERAL

- .1 Design point to be at mid point of scale or range.
- .2 Ranges: dual imperial and metric.

2.2 DIRECT READING THERMOMETERS

- .1 Industrial, variable angle type, liquid filled, accuracy ± 1 scale division, 225 mm scale length: to CAN/CGSB14.4 or ASME B40.200.

2.3 REMOTE READING THERMOMETERS

- .1 100 mm diameter liquid filled or vapor activated dial type: to CAN/CGSB-14.4 or ASME B40.200, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished brass or stainless steel case for wall mounting.

2.4 THERMOMETER WELLS

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: brass or stainless steel.

2.5 PRESSURE GAUGES

- .1 Dial type: 112 mm to ASME B40.100, Grade 2A, stainless steel or phosphor bronze bourdon tube having 0.5% accuracy full scale, 1% accuracy for liquid filled.
- .2 Provide:
 - .1 Siphon for steam service.
 - .2 Snubber for pulsating operation.
 - .3 Diaphragm assembly for corrosive service.
 - .4 Gasketed pressure relief back with solid front.
 - .5 Oil filled for high vibration applications, such as pumps.

3.0 EXECUTION

3.1 GENERAL

- .1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

- .1 Install in wells on piping. Provide heat conductive material inside well.
- .2 Install on inlet and outlet of:
 - .1 Heat exchangers.
 - .2 Heating and cooling coils.
 - .3 Boilers.
 - .4 Chillers.
 - .5 Cooling towers, closed circuit coolers and evaporative condensers.
 - .6 DHW tanks.
 - .7 In other locations as indicated.

- .3 Install wells.
- .4 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

- .1 Install in following locations:
 - .1 Suction and discharge of pumps. (Liquid filled.)
 - .2 Upstream and downstream of PRV's.
 - .3 Upstream and downstream of control valves.
 - .4 Inlet and outlet of coils.
 - .5 Inlet and outlet of heat exchangers.
 - .6 Outlet of boilers.
 - .7 In other locations as indicated.
- .2 Install ball valves.
- .3 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

- .1 Install engraved lamicaid nameplates as specified in Section 23 05 53.01 - Mechanical Identification, identifying medium.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

- .1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 ANSI/MSS SP-69, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)

1.4 SYSTEM DESCRIPTION

.1 Design Requirements

- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 or ASME B31.1.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

.2 Performance Requirements

- .1 Design supports, platforms, catwalks, hangers, to withstand seismic events for location as per the National Building Code

1.5 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings stamped and signed for approval by Region's Representative.
- .3 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

2 Instructions: submit manufacturer's installation instructions.

.1 Region's Representative will make available one (1) copy of systems supplier's installation instructions.

.5 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

2.0 PRODUCTS

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58 and SP-89.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 Upper attachment structural: Suspension from lower flange of I-Beam.

-
- .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 9 mm UL listed, 13 mm FM approved.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, FM approved where required to MSS-SP58 and MSS-SP69.
 - .3 Upper attachment structural: Suspension from upper flange of I-Beam.
 - .1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved where required to MSS SP69.
 - .2 Cold piping NPS 2 1/2 or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved where required.
 - .4 Upper attachment to concrete.
 - .1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved where required to MSS SP-69.
 - .5 Shop and field-fabricated assemblies.
 - .1 Trapeze hanger assemblies: MSS SP-89.
 - .2 Steel brackets: MSS SP-89.
 - .3 Sway braces for seismic restraint systems: to MSS SP-89.
 - .6 Hanger rods: threaded rod material to MSS SP-58.
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
 - .7 Pipe attachments: material to MSS SP-58.

- .1 Attachments for steel piping: carbon steel galvanized.
- .2 Attachments for copper piping: copper plated black steel.
- .3 Use insulation saddles for hot pipework.
- .4 Oversize pipe hangers and supports for insulated pipes.
- .8 Adjustable clevis: material to MSS SP-69, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.
- .10 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated or epoxy coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-69.

2.3 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP-58, type 42, UL listed FM approved where required.
- .2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3.0 m span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-69.

2.5 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report(CMTR).
- .2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger to be complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.
- .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.8 HOUSE-KEEPING PADS

- .1 For base-mounted equipment: Concrete, at least 100 mm high, 50 mm larger all around than equipment, and with chamfered edges.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to be to industry standards.
 - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: Install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
 - .1 vertical movement of pipework is 13 mm or more,
 - .2 transfer of load to adjacent hangers or connected equipment is not permitted.

- .7 Use variable support spring hangers where:
- .1 transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

- .1 Plumbing piping: most stringent requirements of Canadian Plumbing Code
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Hydronic, steam, condensate, rigid, and flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

Maximum Pipe Size: NPS	Maximum Spacing: Steel	Maximum Spacing: Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

- .6 Within 300 mm of each elbow.
- .7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.

- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members, comprised of angel iron or c-channel.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use

recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

- .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
- .2 Sustainable requirements for construction and verification.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

- .1 Canadian Gas Association (CGA)
 - .1 CSA/CGA B149.1-[05], Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-[97], Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-[92], Identification of Piping Systems.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

.2 Health and Safety:

- .1 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

2.0 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers to be raised or recessed.
- .3 Information to include, as appropriate:
- .1 Equipment: Manufacturer's name, model, size, serial number, capacity.
- .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
- .1 Hazardous: red letters, white background.
- .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
- .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:**.1 Conform to following table:**

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.**.4 Locations:****.1 Terminal cabinets, control panels: Use size # 5.****.2 Equipment in Mechanical Rooms: Use size # 9.****2.3 EXISTING IDENTIFICATION SYSTEMS****.1 Apply existing identification system to new work.****.2 Where existing identification system does not cover for new work, use identification system specified this section.****.3 Before starting work, obtain written approval of identification system from Region's Representative.****2.4 PIPING SYSTEMS GOVERNED BY CODES****.1 Identification:****.1 Natural gas: to CSA/CGA B149.1, authority having jurisdiction.****2.5 IDENTIFICATION OF PIPING SYSTEMS****.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.**

.2 Pictograms:

- .1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

- .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

- .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
- .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
- .3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

- .1 To full circumference of pipe or insulation.
- .2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

- .1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
- .2 All other pipes: Pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150oC and intermittent temperature of 200oC.

.7 Colours and Legends:

- .1 Where not listed, obtain direction from Region's Representative.
- .2 Colours for legends, arrows, to following table:

Background colour	Legend, arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Raw water	Green	RAW WATER
River water	Green	RIVER WATER
Sea water	Green	SEA WATER
City water	Green	CITY WATER
Treated water	Green	TREATED WATER
Brine	Green	BRINE
Condenser water supply	Green	COND. WTR. SUPPLY
Condenser water return	Green	COND. WTR. RETURN
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
High temp HW Htg. supply	Yellow	HTHW HTG. SUPPLY++
High temp HW Htg. return	Yellow	HTHW HTG. RETURN++
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Steam ___ kPa	Yellow	___ kPa STEAM
Steam condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)
Steam condensate (pumped)	Yellow	ST.COND.RET (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Chilled drinking water	Green	CH. DRINK WTR

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Building Systems Upgrade – HVAC, LED and Nursing Call, 2387 Industrial St, Burlington

Section 230553
 Identification for HVAC
 Piping and Equipment

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Drinking water return	Green	CH. DRINK WTR. CIRC
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Contaminated lab waste	Yellow	CONT. LAB WASTE
Acid waste	Yellow	ACID WASTE (add source)
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
No. ____ fuel oil suction	Yellow	# ____ FUEL OIL
No. ____ fuel oil return	Yellow	# ____ FUEL OIL
Engine exhaust	Yellow	ENGINE EXHAUST
Lubricating oil	Yellow	LUB. OIL
Hydraulic oil	Yellow	HYDRAULIC OIL
Gasoline	Yellow	GASOLINE
Natural gas	to Codes	
Propane	to Codes	
Gas regulator vents	to Codes	
Distilled water	Green	DISTILL. WTR
Demineralized water	Green	DEMIN. WATER
Chlorine	Yellow	CHLORINE
Nitrogen	Yellow	NITROGEN
Oxygen	Yellow	OXYGEN
Compressed air (<700kPa)	Green	COMP. AIR ____ kPa
Compressed air (>700kPa)	Yellow	COMP. AIR ____ kPa

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Vacuum	Green	VACUUM
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS
Carbon dioxide	Red	CO2
Instrument air	Green	INSTRUMENT AIR
Control air tubing	To Section 25 05 54 – EMCS: Identification	
Conduit for low voltage control wiring	To Section 25 05 54 – EMCS: Identification	
Medical Gases	To Code	

2.7 VALVES, CONTROLLERS

- .1 Brass tags 12 mm diameter with stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates as per this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position, component ID name.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide nameplates on hot and/or insulated surfaces.
- .3 Protection
 - .1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- 2 Adjacent to each change in direction.
- 3 At least once in each small room through which piping or ductwork passes.
- 4 On both sides of visual obstruction or where run is difficult to follow.
- 5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- 8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- 9 Identification to be easily and accurately readable from usual operating areas and from access points.

- .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Region's Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
 - .2 Sustainable requirements for construction and verification.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.

1.3 REFERENCES

- .1 Canadian Gas Association (CGA)
 - .1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.
 - .2 CSAZ7396.1 Medical Gas pipeline Systems – Part 1: Pipelines for medical gases and vacuum.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-24.3, Identification of Piping Systems.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product data to include paint colour chips, other products specified in this section.
 - .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.5 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
 - .2 Dispose of unused paint coating material at official hazardous material collections site approved by Region's Representative.
 - .3 Do not dispose of unused paint coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

2.0 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers to be raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: Manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.

- .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
 - .1 Terminal cabinets, control panels: Use size # 5.
 - .2 Equipment in Mechanical Rooms: Use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Region's Representative.

2.4 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
 - .1 Natural gas: to CSA/CGA B149.1, authority having jurisdiction.

2.5 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
 - .1 Where required, to Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 All other pipes: Pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100%RH and continuous operating temperature of 150oC and intermittent temperature of 200oC.
- .7 Colours and Legends:
 - .1 Where not listed, obtain direction from Region's Representative.

- .2 Colours for legends, arrows, to following table:

Background colour	Legend, arrows
Yellow	BLACK
Green	WHITE
Red	WHITE

- .3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Condenser water return	Green	COND. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Make-up water	Yellow	MAKE-UP WTR
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.
- .3 Identify system: e.g. Supply AHU-1, Exhaust F-7.

2.7 VALVES, CONTROLLERS

- .1 Brass tags 12 mm diameter with stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in section 25 05 54 – EMCS: Identification. If no EMCS included in project, identification as per this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position, component ID name.

2.9 LANGUAGE

- .1 Identification to be in English.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and/or CSA registration plates as required by respective agency.

3.3 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection
 - .1 Do not paint, insulate or cover in any way.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure

that at least one is visible from any one viewpoint in operating areas and walking aisles.

- 2 Adjacent to each change in direction.
- 3 At least once in each small room through which piping or ductwork passes.
- 4 On both sides of visual obstruction or where run is difficult to follow.
- 5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- 9 Identification to be easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification to be approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Region's Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL**1.1 SUMMARY**

- .1 Testing, adjusting, and balancing of HVAC equipment to achieve specified performance requirements.

1.2 RELATED REQUIREMENTS**1.3 REFERENCE STANDARDS**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - .1 ANSI/ASHRAE Standard 111-[2008], Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems
 - .2 Associated Air Balance Council (AABC):
- .2 ANSI/AABC National Standards for Total System Balance, [Seventh Edition, 2016]
 - .1 National Environmental Balancing Bureau (NEBB):
- .3 NEBB Procedural Standard for Testing, Adjusting, and Balancing of Environmental Systems, [Ninth Edition, 2019]
 - .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
- .4 SMACNA 1780-[2002] - HVAC Systems - Testing, Adjusting and Balancing

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Test and balance each system independently and where interlocked with other systems, in unison with those systems.
- .2 Scheduling:
 - .1 Schedule time required for work of this Section (including repairs, and re-testing) into Project schedules to ensure completion before scheduled completion date.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit proposed methodology and procedures for performing work of this Section.
- .2 Before starting work of this Section, submit names and documented qualifications of personnel to perform work of this Section.
- .3 Submit list of instruments and include serial numbers and calibration certificates.
- .4 Preliminary Report: Submit for checking and approval by Region's Representative and/or

Consultant before submission of formal report. Include:

- .1 Details of instruments used
- .2 Details of procedures employed
- .3 Calculations procedures
- .4 Summaries
- .5 Testing and Balancing Report:
 - .1 Format in accordance with [ANSI/AABC National Standards for Total System Balance] and show results in SI units.
 - .2 Include:
 - .1 Project record drawings
 - .2 System schematics
 - .3 Submit six copies of the report to Region's Representative, in English, digital files complete with index tabs.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: Test and balance systems regulated by codes to the satisfaction of the authority having jurisdiction.
- .2 Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum [three] years [documented] experience, [certified by AABC] [certified by NEBB].
- .3 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

2.0 PRODUCTS

3.0 EXECUTION

3.1 PREPARATION

- .1 During construction, coordinate location and installation of measurement and balancing devices, equipment, accessories, measurement ports, and fittings.
- .2 Calibrate instruments in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate instruments within [three] months of work. Submit certificate of calibration.
- .4 Notify Region's Representative and/or Consultant [seven] days before start of work.

3.2 VERIFICATION OF CONDITIONS

- .1 Verify that building is substantially complete, including:
 - .1 Installation of ceilings, doors, windows, and other construction affecting the Work.
 - .2 Application of weatherstripping, sealing, and sealants.
 - .3 Pressure, leakage, and other tests specified elsewhere in Division 23.
 - .4 Provisions for Work are installed and operational.
- .2 Verify proper, normal, and safe operation of mechanical and associated electrical and control systems affecting Work including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Liquid systems:
 - .1 Flushed, filled, and vented.
 - .2 Correct pump rotation.
 - .3 Strainers are in place and baskets are clean.
 - .4 Isolating and balancing valves are installed and open.
 - .5 Calibrated balancing valves are installed at factory settings.
 - .6 Chemical treatment systems are complete and operational.

3.3 SYSTEM START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified in equipment Sections.

3.4 ADJUSTING

- .1 Operate systems as required to perform the work and as required by Region's Representative and/or Consultant for verification of reports.
- .2 Test to verify proper and safe operation, to determine actual point of performance, and to evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .3 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .4 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

3.6 TOLERANCES

- .1 Hydronic systems: +/-[10]% of design.
- .2 Accuracy: +/-[2]% of actual values.

3.7 SITE QUALITY CONTROL

- .1 Reported results [[are] [may be]] subject to verification by Region's Representative and/or Consultant. Verify number and location of results as directed by Region's Representative and/or Consultant.
- .2 Provide personnel and instrumentation to verify up to [30]% of reported results.
- .3 Repeat work as required until results fall within specified performance values.

3.8 CLOSEOUT ACTIVITIES

- .1 After work is completed to satisfaction of Region's Representative and/or Consultant replace drive guards, close access doors, lock devices in set positions, and ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

3.9 MAINTENANCE

- .1 Participate in systems checks twice during Warranty Period - #1 approximately [three] months after acceptance and #2 within [one] month of termination of Warranty Period.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.

1.2 RELATED SECTIONS:

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 01 91 13 - Commissioning (Cx) Requirements.

1.3 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 - .1 SMACNA HVAC Air Duct Leakage Test Manual.

1.4 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
 - .1 Submit proposed report form and test report format to Region's Representative for approval at least three (3) months before proposed date of first series of tests. Do not start tests until approval received in writing from Region's Representative.

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- .2 Prepare report of results and submit to Region's Representative within two (2) working days of completion of tests. Include:
 - .1 Schematic of entire system.
 - .2 Schematic of section under test showing test site.
 - .3 Required and achieved static pressures.
 - .4 Orifice differential pressure at test sites.
 - .5 Permissible and actual leakage flow rate (L/s) for test sites.
 - .6 Witnessed certification of results.
 - .3 Include test reports in final TAB report.
 - .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .5 Instructions: submit manufacturer's installation instructions.
 - .6 Manufacturer's field reports specified.

1.5 QUALITY ASSURANCE

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.

2.0 PRODUCTS

2.1 TEST INSTRUMENTS

- .1 Test apparatus to include:
 - .1 Fan capable of producing required static pressure.
 - .2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.
 - .3 Flow measuring instrument compatible with the orifice plate.
 - .4 Calibration curves for orifice plates used.
 - .5 Flexible duct for connecting to ductwork under test.
 - .6 Smoke bombs for visual inspections.
- .2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.
- .3 Submit details of test instruments to be used to Region's Representative at least three (3) months before anticipated start date.
- .4 Test instruments: calibrated and certificate of calibration deposited with Region's Representative no more than 28 days before start of tests.
- .5 Re-calibrated every six (6) months thereafter.

2.2 EQUIPMENT LEAKAGE TOLERANCES

- .1 Equipment and system components such as duct heating leakage: 2%.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TEST PROCEDURES

- .1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.
- .2 Section of duct to be tested to include:
 - .1 Fittings, branch ducts, tap-ins.

- .3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.
- .4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.
- .5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

- .1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.
- .2 Leakage tests on following systems not to exceed specified leakage rates.
 - .1 Small duct systems up to 250 Pa: leakage 2 %.
 - .2 VAV box and duct on downstream side of VAV box: leakage 2 %.
 - .3 Large low pressure duct systems up to 500 Pa: leakage 2 %.
 - .4 HP duct systems up to 1000 Pa pressure classification, including upstream side of VAV boxes: leakage 1%.
- .3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

- .1 Test ducts before installation of insulation or other forms of concealment.
- .2 Test after seals have cured.
- .3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.
- .4 Flexible connections to VAV boxes.

3.5 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services.
 - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

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- .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .2 Schedule site visits, to review Work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
 - .4 Obtain reports, within three (3) days of review, and submit, immediately, to Region's Representative.
 - .3 Performance Verification:
 - .1 Region's Representative to witness tests and to verify reported results.
 - .4 To be certified by same TAB agency approved by Region's Representative to undertake TAB on this project.

3.6 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 RELATED WORK

- .1 This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 QUALITY ASSURANCE

- .1 Catalogued or published ratings shall be obtained from tests carried out by Manufacturer or from independent testing agency signifying adherence to codes and standards.
- .2 Flame and smoke spread ratings less than 25/50 tested in accordance with CAN/ULC-S102-07 “Test for Surface Burning Characteristics of Building Materials”.

2. PRODUCTS

2.1 BACKDRAFT DAMPERS - LIGHT DUTY

- .1 Minimum Requirements:
 - .1 1.61 mm thick galvanized steel or 1.29 mm aluminum channel frame.
 - .2 0.51 mm thick embossed aluminum blades.
 - .3 Full blade length shafts, brass bearings.
 - .4 Felt or neoprene anti-chatter blade strips.
 - .5 Maximum blade height per section, 600 mm, use multiples for larger dimensions.
 - .6 Maximum blade length of 450 mm, use multiples for larger dimensions.
 - .7 Manufacturer’s label.
 - .8 Where balanced backdraft damper (BBD) is indicated, damper shall incorporate adjustable counter balance weight and lever.
 - .9 Maximum pressure drop across damper at 4.06 m/s shall be 35 Pa.
- .2 Standard of Acceptance: EH Price CBD, Nailor, Ruskin, Westvent.

2.2 BALANCING DAMPERS

- .1 Construction in accordance with SMACNA Duct Standards.
- .2 Minimum Requirements:
 - .1 Rectangular ducts:
 - .1 Up to 300 mm deep - single blade (butterfly type).

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- .2 325 mm to 400 mm deep - two opposed blades, mechanically interlocked with pivots at quarter points.
 - .3 430 mm deep and over - multiple opposed blades, mechanically interlocked with blades not greater than 200 mm deep and pivots equally spaced.
- .2 Round Ducts:
 - .1 Single Blade (butterfly type).
 - .3 Material:
 - .1 Minimum 1.61 mm thick galvanized steel blades on butterfly dampers.
 - .2 Minimum 1.61 mm thick galvanized steel blades on multi-blade dampers with rigidly constructed galvanized steel frame (no frame required on single blade dampers).
 - .3 Minimum 1.27 mm thick stainless steel blades for fume exhaust ducts.
 - .4 Bearings:
 - .1 End bearings on low pressure single blade dampers above 300 mm diameter.
 - .2 Bearings on multiple blade dampers shall be bronze iolite type.
 - .5 Operating Mechanism:
 - .1 Lockable quadrant type with end bearing on accessible rectangular ducts up to 400 mm deep and on accessible round ducts.
 - .2 Wide pitch screw mechanism type with crank operator on accessible rectangular ducts 430 mm and over in depth and on inaccessible rectangular and round ducts.
 - .3 Override limiting stops.
 - .4 No blade movement in set position.
 - .6 Concealed Regulators:
 - .1 For drywall ceilings with no access panels, provide concealed balancing damper regulators embedded in finished ceiling, mounted behind grilles, on or inside plenum slot diffusers and various other types of diffusers. Concealed damper regulator to be connected to balancing damper by means of flexible Bowden cable and installed flush with ceiling. Cover plate held in place with 2 screws and easily removed for damper adjustment. Concealed damper regulator similar to Young Regulator Co. Model No. 270-301. Provide necessary hardware, including Young Regulator balance damper model 5020- CC, Bowden cable and Young Regulator Model 030-12 wrench.
 - .2 Drawing designation: D(CR).

2.3 DUCT AND PLENUM ACCESS

.1 Dimensions:

.1 Doors:

- .1 500 mm wide x 1,350 mm high.
- .2 Head of door 1,780 mm above floor.

.2 Panels:

- .1 380 mm x 500 mm.
- .2 Where far corners of the duct are closer than 500 mm and equipment within duct is closer than 300 mm size may be reduced to 400 mm x 300 mm or 450 mm x 250 mm elliptical.
- .3 Where space will not permit above dimensions they should be matched as closely as possible and additional access provided as required.

.2 Products:

- .1 Doors - construct in accordance with SMACNA Duct Standards Figure 6-12 except for latch type. 38 mm thick insulation.
- .2 Panels - Nailor Hart, Ventlok, 25 mm thick insulation.
- .3 Gaskets - neoprene or foam rubber.

.3 Hardware:

- .1 Panels up to 400 mm x 300 mm - 2 sash locks.
- .2 Panels - 380 mm x 500 mm - 4 sash locks.
- .3 Doors - piano hinge and Ventlok 310 latches complete with front and inside handles and front door pull.

2.4 DUCT CONNECTORS - VIBRATION ISOLATION

- .1 Provide flexible duct connections to provide vibration isolation at duct and plenum connections to fan and air handling units. See Figure 2-19 SMACNA Duct Standards.

.2 Minimum Requirements:

- .1 Pre-assembled 75 mm minimum long flexible connection with 75 mm long 0.70 mm galvanized steel duct connectors on each side of flexible connection. Flexible connector- fibre glass fabric with elastomer coating.
- .3 Centrifugal fans with 914 mm diameter and larger fan wheels, use 150 mm long flexible connection.
- .4 Do not install connectors on perchloric acid fume exhaust systems.
- .5 Standard of Acceptance: Duro Dyne “Durolon,” Dynair “Hypalon,” Ventfabrics “Ventlon.”

2.5 DUCTWORK - FLEXIBLE – PLAIN

- .1 Provide factory fabricated plain, flexible air ductwork for the following applications:
 - .1 Connections to air terminals.
 - .2 Connections to downstream side of mixing boxes/air valves.
 - .3 Connections to round fire dampers (up to 300 mm diameter).
- .2 Minimum Requirements:
 - .1 Non-corrosive spirals wire reinforcing flexible vinyl coated fibreglass cloth membrane.
 - .2 Suitable for up to 2,500 kPa positive static pressure and 250 Pa negative static pressure.
 - .3 UL or ULC labelled, Class 1, duct connector.
 - .4 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.
- .3 Standard of Acceptance: Flexmaster FAB4, Thermaflex SLP10, ATCO UPC#017 Class ‘O’.

2.6 DUCTWORK - FLEXIBLE - INSULATED

- .1 Provide factory fabricated insulated flexible ductwork for the following application:
 - .1 Connections to downstream side of variable volume and consistent volume mixing boxes, where indicated.
 - .2 Connections to air terminals where indicated.
- .2 Minimum Requirements:
 - .1 Flexible vinyl coated steel helix bonded to inner duct liner. Fibrous glass thermal insulation.
 - .2 Outer jacket of metalized fire-resistant vapour barrier.
 - .3 Suitable for up to 500 Pa positive static pressure and/or 250 Pa negative static pressure.
 - .4 UL or ULC labelled, Class 1, duct connector.
 - .5 Acoustically rated.
- .3 Standard of Acceptance: Gladd-Flex ABL-181, Thermaflex M-KE, Wiremold WK, ATCO UPC#070.

2.7 DUCTWORK AND PLENUM SEALERS

- .1 Provide duct sealing compounds for use in fabrication of ductwork and plenum joints.
- .2 Low Pressure Systems - SMACNA Seal Classification B. Medium and High Pressure Systems - SMACNA Seal Classification A.

.3 Standard of Acceptance:

- .1 Foster 32-14, Hardcast Versa Grip, Hardcast Foil Grip 1402, Robson's Duct Seal-WB, United Duct Sealer, Trans Continental Multi-Purpose.
- .4 Where accessible, apply sealer to inside of joints on ducts and plenums under positive pressure - e.g. discharge side of fans.
- .5 Apply sealer to outside of joints on ducts and plenums under negative pressure - e.g. suction side of fans.

2.8 FIRE DAMPERS

.1 Minimum Requirements:

- .1 Fire dampers shall be ULC or Warnock Hersey tested and shall bear testing agency's label.
- .2 Fire dampers shall meet requirements of National Building Code and authorities having jurisdiction.
- .3 Fire dampers shall be "dynamic," rated to close under airflow, where the air system runs during a fire alarm condition.
- .4 Fire dampers may be static type in applications where there is no airflow/air system is off in a fire alarm condition.
- .5 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire separation.
- .6 Fusible link actuated, weighted to close and lock in closed position when released or having negator- spring-closing operator for multi-leaf type in horizontal position with vertical airflow.
- .7 Fire dampers in low-pressure ductwork may be multi blade or curtain type.
- .8 Fire dampers in medium and high pressure ductwork shall be curtain type.
- .9 Curtain fire dampers shall be blades retained in recess so free area of connecting ductwork is not reduced.
- .10 Fusible links: ULC approved with melting point of 74°C on supply, return and exhaust air systems. Use fusible links with melting point of 141°C on return and exhaust air systems if used for smoke venting.
- .11 Standard of Acceptance:
 - .1 Type B or C.

2.9 FIRE DAMPERS - CEILING

.1 Minimum Requirements:

- .1 ULC tested and labelled.
- .2 Spring loaded heat retardant blanket or insulated damper blades.
- .3 74°C fusible links.
- .4 Where diffuser/grille neck is smaller than diffuser/grille face area, provide UL

listed CK 2000 thermal blanket over ceiling plenum side of exposed diffuser/grille.

- .5 Install above each diffuser/grill mounted in fire rated ceiling.
- .6 Provide transition plates (round to rectangular).

- .2 Standard of Acceptance: Price, Ruskin CFSR, Nailor Hart.

2.10 FIRE DAMPERS - COMBINATION REGISTER DAMPER

- .1 Minimum Requirements:

- .1 Warnock- Hersey tested and labelled.
- .2 Combined opposed blade damper with spring tensioned fusible link.
- .3 Fasten to 3.51 mm thick steel sleeve, welded with integral flange on register side.

- .2 Standard of Acceptance: EH Price VCS-4, Tuttle & Bailey 90A.

- .3 Airflow probe (Duct or Fan Inlet)

- .1 Aluminum construction.
- .2 Multiple traverse probes.
- .3 Traverse probe to contain multiple total and static pressure sensors located along exterior surface of probe and internally connected to respective averaging manifolds.
- .4 Threaded end support rod and mounting plate with gasket and signal fittings.
- .5 Fan inlet probes (two per inlet) with dual end support swivel brackets suitable for mounting in fan inlet bell.
- .6 Capable of producing an output signal linear and scaled to air volume (4-20 mADC, 0-10 VDC, 0-5VDC).
- .7 Capable of local digital display of continuous indication of air volume.

- .8 Standard of Acceptance:

- .1 Air monitor VOLU-probe/7200AZ (Duct).
- .2 Air monitor VOLU-probe/7200AZ (FanInlet).

2.11 INSTRUMENT TEST PORTS

- .1 Application:

- .1 Provide instrument test ports in each plenum access door (unless more than one door serves a plenum compartment).
- .2 Locate ports to permit easy reading of instruments.

.2 Minimum Requirements:

- .1 1.61 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 25 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

.3 Standard of Acceptance: Duro Dyne IP1 or IP2.

3. **EXECUTION**

3.1 **BALANCING DAMPERS**

- .1 Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger duct as required for proper air balancing, complete with 25 mm high stand-off bridges for operators to allow full, continuous duct insulation.
- .2 Provide balancing dampers at each run out to grille or diffuser.
- .3 Identify airflow direction and blade rotation and open and closed position
- .4 On round ductwork larger than 300 mm diameter and externally insulated rectangular ductwork, provide sheet metal bridge to raise quadrant type operator above insulation thickness (coordinate with Section 23 07 13). Provide open end bearing where bridges are used. Bridges on uninsulated round ducts shall be at least 25 mm high.
- .5 Where quadrant type operators are used, lever shall be arranged parallel with damper blade, complete with 25 mm high stand-off bridge for operators to allow continuous duct insulation to be applied on the duct.

3.2 **BACKDRAFT DAMPERS**

- .1 Install backdraft dampers on exhaust and relief openings through building walls and roof on exhaust fans where control dampers are not called for or indicated.

3.3 **CONTROL DAMPERS - AUTOMATIC**

- .1 Packaged equipment specified to be complete with control dampers, shall include control dampers as normally supplied by equipment Manufacturer unless otherwise noted.
- .2 Other automatic control dampers are specified in Controls Sections.
- .3 Under this section be responsible for receipt, handling, storage and installation of control dampers supplied under Control or other Sections.
- .4 Indicated size of control dampers is dimension outside frame. Oversize ductwork to include depth of damper frame if pressure drop across damper exceeds 25 Pa.

- .5 Control damper frames shall be fitted tightly into ductwork and sealed airtight.
- .6 Check that dampers are installed square and true. Ensure damper end linkages are easily accessible. Provide saw-cuts with black paint in the exposed ends of all damper shafts, aligned with damper blade for visual indication of damper blade position.
- .7 Do not install control dampers in thickness of wall unless otherwise indicated.

3.4 DUCT AND PLENUM ACCESS

- .1 Locations: Provide access doors and panels as follows:
 - .1 Doors: where indicated on drawings.
 - .2 Panels:
 - .1 Every 12 m on ductwork.
 - .2 Base of each duct riser.
 - .3 Both side of equipment blocking duct e.g.
 - .1 Air flow measuring stations.
 - .2 Coils.
 - .4 At or to one side of other equipment in duct, e.g.
 - .1 Backdraft dampers (counter weight side).
 - .2 Balance dampers serving multiple outlets/inlets.
 - .3 Bearings (fans/motors).
 - .4 Control dampers.
 - .5 Control sensors.
 - .6 Fire dampers (rectangular ducts and round ducts 325 mm diameter and larger - latch side).
 - .7 Heat detectors (upstream from device)
 - .8 Smoke dampers (operator side).
 - .9 Smoke detectors (upstream from device).
 - .5 Panels need not be provided where access is available through door or register mounted to side of duct.
- .3 Patches:
 - .1 Where required for cleaning and where access panels are not specified e.g. on both sides of turning vanes.
- .4 Flexible duct - on round duct and round fire dampers up to 300 mm diameter.
- .2 Seal Frames airtight.
- .3 Install to not interfere with airflow.
- .4 Install to provide access for service and cleaning.
- .5 Do not use sheet metal screws for attaching access panels to ductwork.

- .6 Round ducts 325 mm diameter and larger shall include a short collar for installation of access panels.
- .7 Small rectangular ducts shall be transitioned to minimum dimension across duct of 325 mm for installation of access panels.

3.5 DUCT CONNECTORS - VIBRATION ISOLATION

- .1 Ensure flexible duct connectors do not reduce duct free area on suction side of fans.

3.6 DUCTWORK - FLEXIBLE

- .1 Installed lengths shall be limited to 6 times duct diameter but not longer than 1.2 m.
- .2 Connect to ductwork and diffusers with stainless steel worm drive clamps or Panduit adjustable clamps or Thermaflex duct strap applied over two wraps of duct tape. Use stainless steel clamps on connections to fire dampers.
- .3 Minimum centreline radius of flexible ductwork bend shall be 1.5 times duct diameter, alternatively, sheet metal elbow may be used at branch takeoffs and boot diffuser connections.
- .4 Support with 25 mm x 0.85 mm galvanized steel straps at a maximum of 600 mm. Straps shall completely encircle duct.
- .5 Support clear of ceiling assembly, light fixtures and hot surfaces.

3.7 FIRE DAMPERS

- .1 Install in accordance with the SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems - Fourth Edition 1992. Demonstrate fire damper drop tests [**ALL / 50% / 25% / 10%**] of fire dampers installed in this project.
- .2 Fire damper sleeves must not extend more than 75 mm from wall on each side.
- .3 Fire dampers shall be installed within wall thickness of fire separation.
- .4 Wall openings sized to allow sleeve/damper expansion.
- .5 Arrange dampers so linkages and locking catches are accessible from access side of fire damper.
- .6 Install to close in direction of normal airflow.
- .7 Size so free area of duct is maintained through assembly. All fire dampers shall be Type B – blades out of airstream, unless specifically noted otherwise or as required for specific installation.
- .8 Install in galvanized steel sleeve, retained in place with retaining angles on four sides at each face of wall.

- .9 Connect ductwork to damper sleeves using break-away duct joints on faces.

3.8 FLOW MEASURE DEVICES - AIR

- .1 Install in accordance with Manufacturers recommendations. Minimum distance from air turbulence - producing fittings, transitions etc shall be maintained.
- .2 Mount air volume gauges at height for easy visual inspection and install interconnection piping.

END OF SECTION

1. **GENERAL**

1.1 **Related Work**

- .1 This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 **General**

- .1 Provide external thermal insulation for plenums and ductwork where specified.
- .2 Provide internal acoustical insulation for plenums and ductwork where specified.
- .3 Journeyman insulation applicators shall perform work.
- .4 Be responsible for ensuring sufficient space is provided for proper installation of insulation materials.
- .5 All insulation shall be in accordance with latest edition of the “Master Insulators Association of Ontario Standards Manual” as reference standard.
- .6 Install insulation and related materials and accessories in accordance with the Manufacturer’s recommended installation instructions.

1.3 **Regulatory Requirements**

- .1 Flame spread ratings and smoke developed classifications shall be as required by applicable code and NFPA 90A. Flame spread rating throughout material shall not exceed 25 and smoke developed shall not exceed 50. Materials shall not flame, smoulder, smoke, or glow at temperatures they are exposed to in service.
- .2 Minimum insulation thickness and insulating values shall be in accordance with ASHRAE Std 90.1 0 Latest Edition. or as per the schedule in this Specification, whichever is more stringent.
 - .1 Fibreglass duct wrap shall comply with: 1. CAN 4-S102.
 - .2 2. CAN/CGSB-51.5M; Tye II (FSK Facing).
 - .3 3. CAN/CBSB-51.11-92.
 - .4 CCG Low FS Laminate Cert. #GI-141.
 - .5 ULC Listed.
 - .6 ASTM C 553; Type I, II III
 - .7 ASTM C 795.
 - .8 ASTM C 1136; Type II (FSK and PSK facings only)
 - .9 ASTM C 1290; Specification for flexible fibrous glass blanket/HVAC ducts.
 - .10 ASTM E-84 Surface Burning Characteristics, 25/50 Flame/Smoke.
 - .11 CAN/ULC-S102-07 “Test for Surface Burning Characteristics of Building
 - .12 Materials”.
- .3 Fibreglass insulation board shall comply with:

-
- .1 CGSB 51-GP-52M (facings).
 - .2 ASTM C 612.
 - .3 ASTM C 795.
 - .4 ASTM E-84 Surface Burning Characteristics, 25/50 Flame/Smoke.
 - .5 CBSB 51-GP-10M
 - .6 CAN-4-S102.
 - .4 Duct liner (internal lining) shall comply with:
 - .1 1. CAN 4-S102.
 - .2 2. CAN/CGSB 51.11-92.
 - .3 ULC listed.
 - .4 ASTM C 1071; Type I.
 - .5 NFPA 90A and 90B.
 - .6 Microbial Growth; ASTM C 1338, G21, G22.
 - .5 Qualifications and Samples
 - .1 Submit Manufacturer documentation (and samples when requested) for materials, applications and finishing methods to establish they satisfy specification and meet applicable code requirements, before commencing work.
 - .6 Definitions
 - .1 “Concealed” means insulated mechanical services in furred spaces, shafts and hung ceilings.
 - .2 “Exposed” will mean not concealed.

2. **PRODUCTS**

2.1 **External Flexible Insulation**

- .1 External flexible glass fibre insulation with integral vapour barrier.
 - .1 Minimum density – 1.0 lb/ft³
 - .2 Thermal conductivity at 24° C - 0.042 W/m/°C.
 - .3 Acceptable Manufacturers:

1. Certainteed STD Ductwrap #75 FSK, Manson Alley-Wrap FSK, Owens Corning all service faced duct wrap, Knauf FSK Ductwrap, Schuller Micro Lite FSK.

2.2 Duct Liner

.1 Rigid Duct Liner.

- .1 Yellow or light coloured internal rigid glass fibre acoustical insulation with black sealer coating on one face.
- .2 Minimum sound absorption (NRC) of 0.60 as tested per ASTM C423 using Type “A” mounting.
- .3 Thermal conductivity at 24° C - 0.035 W/m/°C.
- .4 Acceptable Manufacturers:
 1. Certainteed Toughgard 300#, Manson Akousti-Liner R, Knauf Rigid Plenum Liner, Schuller Permacoat R300, Owens Corning Rigid Coated Duct Liner.

2. Flexible Duct Liner

- .1 Yellow or light coloured internal flexible glass fibre acoustical insulation with one face faced with non- woven fibreglass mat.
- .2 Minimum sound absorption (NRC) of 0.60 as tested per ASTM C423 using Type “A” mounting.
- .3 Thermal conductivity at 24° C - 0.040 W/m/°C.
- .4 Acceptable Manufacturers:
 1. Certainteed Toughgard Duct Liner 150# or Type 150, Manson Akousti- Liner, Knauf Duct LinerEM, Owens Corning Areomat Duct Liner, AP Coilflex/AP Armaflex by Armacell.

3. Grease Duct Enclosure System Fire-Wrap:

- .1 For applications where NFPA-96 kitchen exhaust ducts are to be wrapped in a fire-rated material, provide Morgan Thermal Ceramics FireMaster® Fastwrap®-XL. Duct enclosure flexible blanket composed of high temperature fibers classified for applications to 2192°F (1200°C) and fully encapsulated in glass fiber reinforced foil faced finish. Must be ULC listed for 1 and 2 hour fire resistive enclosure protection, and for zero clearance for kitchen exhaust ducts. Minimum 1-1/2” (38 mm) thick, 6 lbs/cu.ft. (96 kg/m³) density, Greengaurd Microbial Resistance Listing, and compliant to IMC, NFPA-96, UMC and CMC. Frame and smoke spread rating less than 25/50.

2.3 Accessories

- .1 Insulation Adhesive
 - .1 Bakelite 230-39, Childers CP-82, CP-56W, Epolux Cadoprene 400, Foster 85- 20, Polymer Glasstack #25, Robson Ticki-Tuff.
- .2 Vapour Barrier Tape.
 1. Finishing tape to meet flame spread rating and smoke developed classification requirements of applicable code and compatible with facing material.
 2. Scrim foil self-adhesive tape.
3. Vapour Barrier Adhesive.
 - .1 Bakelite 230-21, Childers CP-82, Epolux Cadoprene 400, Foster 85-20, 3M 4230.
4. Insulation Coating
 - .1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36, Robson White Lag.
5. Weather Coating - vapour barrier.
 - .1 Bakelite 110-14, Childers CHIL-PRUF CP22/23/24, Foster 60-25, Insul-Mastic 15187.
6. Reinforcing Membrane.
 - .1 Glass reinforcing membrane as commercially available.
7. Seal Coating
 - .1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36, Robson White Lag.
8. Fabric Adhesive.
 - .1 Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36.
9. Fabric Coating.
 - .1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.

2.4 Duct Insulation Schedule and Thickness

- .1 External Flexible Insulation with vapour barrier. (Exposed within room which is being served by exposed ducts, do not require external insulation).

Service	Thickness
Cooling and heating supply ducts - where temperature difference between space where duct is located and design air temperature in duct is less than or equal to 22.2°C.	25 mm
All cooling and heating supply ducts - where the temperature difference between the space within which the duct is located and the design air temperature in the duct is greater than 22.2°C.	50 mm
Outdoor air ductwork and plenums (from intake to mixing plenum).	50 mm
Combustion intake/relief air.	50 mm
Exhaust air discharge through roof (including sides and bottom of	50 mm
Exhaust air ductwork outside the building.	25 mm
All exhaust air ductwork from the outside wall or roof to 1.5 m inside building.	38 mm

2 Internal Flexible Duct Liner

Service	Thickness
All ductwork where indicated by single hatching.	25 mm
All supply ductwork in the mechanical room (From AHU discharge to duct shaft, or to 3M beyond fan/mechanical room).	50 mm

3 Internal Rigid Duct Liner

Service	Thickness
Built-up site fabricated air handling unit(s). Line sheet metal walls and tops from inlet dampers to discharge dampers. Do not line transverse walls containing coils, filters or fan discharge.	50 mm
Built-up site fabricated heat recovery exhaust unit(s). Line sheet metal walls and tops.	50 mm
Cold and hot supply air plenums. Line walls, tops and bottoms from discharge dampers to supply duct connections.	50 mm
All outdoor air plenums. Line sheet metal walls and top.	50 mm

3. **EXECUTION**

3.1 Application

- 1 Apply external insulation to ductwork only after tests have been made and systems accepted.

- .2 Apply insulation and insulation finish so finished product is uniform, smooth in finish, with longitudinal seams concealed from view. Apply ductwork insulation materials, accessories and finishes in accordance with Manufacturer's recommendations.
- .3 Insulation and vapour barrier shall be continuous through non-rated separations.
- .4 Grease and fire rated flexible duct insulation shall be applied and installed in accordance with the Manufacturer's instructions.

3.2 Insulation Termination

- .1 Terminate insulation short of control, smoke and fire dampers so as not to interfere with operation.

3.3 Insulation for Cooling Coil Headers and Return Bends

- .1 Pack flexible glass fibre insulation around headers and return bends on all cooling coils in built up air handling units and at re-cool coils in terminal ductwork systems to control condensation

3.4 External Flexible Insulation with Vapour Barrier

- .1 Adhere insulation with insulation adhesive applied in 150 mm wide strip on 300 mm centres.
- .2 On rectangular duct work and plenums, over 600 mm in width, spotweld pins 6.0 mm longer than insulation thickness, one per square foot of duct minimum. If pins are installed in field, capacitor gun shall be used. Impale insulation over pins, and hold in place using metal or nylon clips (washers). Alternatively, use assembly consisting of welded pin with integral head washer welded in place over insulation (Clinched pins not acceptable).
- .3 Adhere foil faced vapour barrier tape over butt joints, raw edges, holding washers and other points of penetration of vapour barrier jacket on exposed hot and cold ducts and concealed cold ducts. Provide 16 ga wire wrap on 600 mm centers as additional exterior insulation reinforcing, to snug-tight so insulation is not crushed/compressed.

3.5 Internal Flexible Duct Liner Application

- .1 Adhere insulation with insulation adhesive applied to whole of metal surface, with the coating side of insulation exposed to airstream.
- .2 Ducts 600 mm in width and less require no further adhesion.
- .3 Duct sides and plenum panels greater than 600 mm in width shall have metal clips or nylon pins adhered to metal surface at 300 mm to supplement adhesive. (Welding pins may be used provided capacitor type gun is used.) Impale insulation or pins or clips with coated side of insulation exposed to airstream and secured with holding washers. Cover holding washers with reinforcing membrane and insulation coating/sealer.

- 4 Seal transverse joints, raw edges, and other points of penetration of coating with reinforcing membrane and insulation coating/sealer.
- .5 Seal longitudinal joints with insulation coating sealer.
- .6 No raw edges of internal insulation material shall be exposed to moving airstream. Provide 26 ga sheet metal hosing at all leading edges of exposed lining, to overlap insulation by at least 25 mm downstream.
- .7 Duct size indicated is inside dimension of the insulation. Metal duct sizes shall be increased to allow for internal acoustic insulation thickness.

3.6 Ductwork Insulation Finished

- .1 “Concealed” ductwork insulation, in horizontal and vertical service spaces, will require no further finish.
- .2 “Exposed” ductwork insulation, in unfinished floor space will have no further finish.
- .3 “Exposed” duct insulation in warehouse type spaces shall be painted with one sealer coat of insulation coating.
- .4 “Exposed” ductwork insulation in finished floor spaces, fan rooms, and boiler room shall be finished with two coats of white, foil-finishing, insulation coating.

END OF SECTION

1.0 GENERAL**1.1 SUMMARY****.1 Section Includes:**

- .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal
- .3 Section 23 05 53.01 – Mechanical Identification.

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1, Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings (Including all Addenda).
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM B209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
 - .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M, Standard Specification for Mineral Fibre-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533 Standard specification for Calcium Silicate Insulation Block and Pipe.
 - .6 ASTM C547 Standard Specification for Mineral Fibre Pipe Insulation.
 - .7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

- .8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .9 ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets.
- .5 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .7 National Energy Code of Canada for Buildings (NECB).

1.4 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.
- .2 TIAC ss:
 - .1 CRF: Commercial Rectangular Finish
 - .2 CPF: Commercial Piping Finish.

1.5 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

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- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.
 - .5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions to Region's Representative.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: certified in performing work of this Section and have at least 5 years' successful experience in this size and type of project, qualified to standards of TIAC.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Region's Representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site approved by Region's Representative.

2.0 PRODUCTS

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

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- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 °C mean temperature when tested in accordance with ASTM C335.
 - .3 TIAC Code A-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
 - .1 Insulation: to ASTM C533.
 - .2 Maximum "k" factor: to 0.075 W/m °C @ 500 °C.
 - .3 Design to permit periodic removal and re-installation.
 - .4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.
 - .5 TIAC Code A-6: Flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket to ASTM C534.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: 0.039 W/m – °C.
 - .4 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants
 - .5 Flame spread index less than 25, and smoke developed index less than 50.
 - .6 TIAC Code C-2: Mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.

2.3 INSULATION SECUREMENT

- .1 Tape: Self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.

- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.5 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.6 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to ASTM D1784 with pre-formed shapes as required.
 - .2 Colours: to match adjacent finish paint. Confirm colour with Region's Representative.
 - .3 Minimum service temperatures: -20°C.
 - .4 Maximum service temperature: 65°C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.55 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
 - .3 Pressure sensitive vinyl tape of matching colour.
 - .8 Special requirements:
 - .1 Indoor: flame spread rating 25, smoke developed rating 50.
 - .2 Outdoor: UV rated material at least 0.5 mm thick.
- .2 Canvas:
 - .1 220gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

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- .2 Lagging adhesive: Compatible with insulation.
 - .3 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Embossed or corrugated.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
 - .4 Stainless steel:
 - .1 Type: 304 or type 316.
 - .2 Thickness: 0.25 mm.
 - .3 Finish: Smooth.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

3.0 EXECUTION

3.1 MANUFACTURE'S INSTRUCTIONS

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

3.2 PRE- INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified. Insulate vent pipes 3.0 m from roof penetration.
- .2 TIAC Code: A-2.
 - .1 Insulation securements: 18 ga SS wire or 12 mm x 0.51 mm SS bands at 300 mm oc.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: Tape at 300 mm oc.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.

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- .4 TIAC Code: A-6.
 - .1 Insulation securements: as per manufacturer's recommendation.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-CA.
 - .5 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Insulation securements: 18 ga SS wire or 12 mm x 0.5 mm SS bands at 300 mm oc.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
 - .6 Thickness of insulation to be as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

.3

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
	Run out			to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Condensate Return	60 - 94	A-3	25	38	38	38	38	38
Boiler Feed Water		A-3	25	25	25	25	25	25
Hot Water Heating	60 - 94	A-3	25	38	38	38	38	38

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
	Run out			to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic HWS		A-3	25	25	25	38	38	38

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
	Run out			to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic CWS		A-3	25	25	25	25	25	25

-
- .7 Finishes:
 - .1 Exposed indoors: PVC jacket.
 - .2 Exposed in mechanical rooms: PVC jacket.
 - .3 Concealed, indoors: canvas on valves, fittings. No further finish.
 - .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
 - .5 Outdoors: Water-proof Aluminum, or SS jacket.
 - .6 Finish attachments: SS screws or bands, at 150 mm oc. Seals: wing or closed.
 - .7 Installation: To appropriate TIAC code CPF/1 through CPF/5.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL**1.1 Related Work**

- .1 This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Quality Assurance

- .1 Motors shall be UL listed and CSA certified.
- .2 Full Voltage Start Applications:
 - .1 All motors shall be in accordance with the National Electrical Manufacturers Association (NEMA) standards, and CSA C390. Motors also shall comply with applicable portions of Canadian Electrical Code.
- .3 Variable Frequency Drive and soft start applications:
 - .1 Motors shall be in accordance with NEMA standards (MG-1) Part 31 and inverter duty class. Motors also shall comply with applicable portions of Canadian Electrical Code.
 - .2 Motors connected to VFDs shall be wound using inverter spike resistant magnet wire capable of 1600V.
- .4 Electronic Commutation Motors (ECM) shall be provided in unitary equipment as specified in their respective sections (small fans, pumps, etc.).
- .5 Noise level of each motor shall comply with NEMA standards, less than 80 dBA at 1 meter.

1.3 Submittals

- .1 Submit data of test method used and motor efficiencies with shop drawings.

2. PRODUCTS**2.1 Electric Motors - General**

- .1 Provide motors for mechanical equipment as specified.
- .2 Unless noted otherwise, provide open drip-proof, ball or roller bearing motors with grease fittings.
- .3 Motors shall have standard voltage ratings consistent with project distribution voltages. Motors less than 0.37 KW to be 120 volt, 60 cycle, single phase power. Motors 0.37 KW and larger to be 3 phase power and for scheduled voltage. Confirm electric voltage, phase and starter requirements with electrical specification.

- .4 Motors shall be designed and manufactured to operate with $\pm 10\%$ voltage and $\pm 5\%$ frequency variations of the nameplate ratings.
- .5 Motors shall be rated for 1.15 service factor in 40°C ambient environment.
- .6 Motors shall be standard 1750 RPM unless specifically scheduled otherwise.
- .7 Provide motors with terminal boxes, suitable for power connections
- .8 Provide screw adjustable bases on belt-connected motors.
- .9 Motors shall be of capacitor start type when they may be manually cycled from starting switch, located in finished space.
- .10 Lubricate motors exposed to outdoor temperature with lubricants suitable for operation at the lowest temperature indicated by the Climatic Information contained in the National Building Code for the location in which they are installed.

2.2 Electric Motors - Premium Efficient

- .1 Motors shall be provided with premium efficiency inverter duty classification with non-wicking leads, class 'B' for ODP motors (pumps only) and class 'F' for TEFC motors insulation (minimum)., complete with motor shaft grounding for all variable speed/frequency driven motors.
- .1 Premium efficiency open drip-proof motors shall have the following typical full load efficiencies (nominal):

HP	Premium Efficient - Minimum Efficiency (%)		
	3500 RPM	1750 RPM	1150 RPM
1	80.0	85.5	82.5
1.	84.0	86.5	86.5
2	85.5	86.5	87.5
3	86.5	89.5	88.5
5	91.0	89.5	90.2
7.	88.5	91.0	92.4
10	90.2	91.7	92.4
15	91.0	93.0	92.4
20	92.5	93.0	92.4

- .2 Premium efficiency inverter duty totally enclosed fan cooled motors shall have the following typical load efficiencies(nominal).

HP	Premium Efficient - Minimum Efficiency (%)		
	3500 RPM	1750 RPM	1150 RPM
1	n/a	85.5	81.5
1.	85.5	85.5	86.5
2	85.5	85.5	87.5
3	87.5	88.5	88.5
5	89.5	89.5	89.5
7.	91.0	91.7	91.7
10	91.7	91.7	91.7
15	91.7	92.4	91.7
20	92.4	93.0	92.4

ECM Motors (Electronic Commutation Motors) shall be provided for unitary equipment in their respective sections. ECM motors shall be permanently lubricated complete with heavy duty ball bearings to match the device (fan, pump, equipment type) and pre-wired to the specific voltage and phase. Interior motor circuitry shall convert the supplied AC power to the motor to DC power to operate the motor. Motor shall be speed controllable down to 20% of rated full speed. Speed shall be controlled by either a Potentiometer dial mounted at the motor, or by a 0-10V signal from controls. Motor shall be a minimum of 85% efficiency at all speeds.

2.3 Belt Drives

- .1 Provide belt drives to the following requirements:
- .1 Steel, cast-iron or aluminum sheaves for motors less than 0.56 KW.
 - .2 Steel or cast-iron sheaves keyed to shafts, for motors 0.56 KW and larger.
 - .3 For motors less than 10 HP, provide standard adjustable pitch drive sheaves having $\pm 10\%$ range. Use mid- position of range for specified RPM.
 - .4 For motors 7.5 KW and larger, provide fixed pitch drive sheaves with split tapered bushing and keyway. Provide final drive sheaves of size to suit final balancing.
- .2 Match drive and driven sheaves.
- .3 V-belts shall conform with the American Belt Manufacturers standards. Multiple belts shall be matched sets.
- .4 Not less than 2-belt configuration is required for each drive for motors 0.56 KW and larger.

- .5 Minimum drive rating shall be 150% of nameplate rating of motor. Keep overhung loads within Manufacturer's design requirements on prime mover shafts.
- .6 Motor slide rail adjustment baseplate with double draw bolt shall allow for centre line adjustment.
- .7 Tension belts to manufacturer's recommendations before start-up and after 100 hours of operation using calibrated belt tensioning gauge.
- .8 Provide one spare set of belts for each piece of equipment with each belt separately identified for the equipment item served.

2.4 Shaft Couplings

- .1 Shaft couplings shall be of the pin or jaw neoprene insert type, gear type, or flexing steel insert type and shall allow coupling inserts to be easily removed without disassembly of equipment.

2.5 Guards

- .1 Provide removable protective guards on exposed V-belt drives and shaft couplings in accordance with Worker's Compensation Board requirements.
- .2 Guards for drives shall have:
 - .1 1.31 mm expanded metal screen welded to 25 mm steel angle frame.
 - .2 1.61 mm thick galvanized sheet metal tops and bottom.
 - .3 Removable sides(s) for servicing.
 - .4 38 mm diameter holes on both shaft centres for insertion of tachometer.
 - .5 Sectionalize if necessary so one man can handle removal
- .3 Provide means to permit lubrication and use of test instruments with guards in place.
- .4 Fabricate and install belt guards for V-belt drives to permit movement of motors for adjusting belt tension and for belt slap.
- .5 Provide removable "U" shaped guards for flexible couplings with 2.75 mm thick galvanized frame and 1.61 mm thick expanded mesh face.
- .6 Provide guards on unprotected fan inlets and outlets. Guards to be provided by fan Manufacturer.
- .7 Prime coat guards and finish paint to match equipment.
- .8 Secure guards to equipment allowing for ease of removal.

3. EXECUTION**3.1 Electric Motors**

- .1 Unless otherwise noted starters and protection devices will be included under Electrical Division.
- .2 Assist Electrical Division to ensure proper connection, correct thermal overload protection and correct motor controls.
- .3 Where starters included in this Division as integral part of packaged equipment, they shall contain thermal overload protection.

3.2 Setting and Alignment

- .1 Employ journeyman millwright to align V-belt drives and/or shaft coupling drives prior to initial start-up. Millwright shall check that centrifugal fan wheels are properly centered on fan shafts.
- .2 Align shaft couplings to within ± 0.051 mm after grouting is complete and piping system is operational.
- .3 Align V-belt drives using straight edge.
- .4 Submit certificate from millwright, certifying that shaft couplings and V-Belt drives have been aligned and centrifugal fan wheels centered prior to initial start- up and checked again after final system balance adjustment.

END OF SECTION

1. GENERAL

1.1 SUMMARY

.1 Section Includes:

- .1 HVAC commissioning description.**
- .2 HVAC commissioning responsibilities.**

1.2 REFERENCES

.2 American Society of Heating, Refrigerating and Air-Conditioning Engineers:

- .1 ASHRAE Guideline 1 - The HVAC Commissioning Process.**

.3 Building Commissioning Association:

- .1 BCA - Commissioning Handbook.**

.4 National Environmental Balancing Bureau:

- .1 NEBB - Procedural Standards for Building Systems Commissioning.**

.5 Testing Adjusting and Balancing Bureau:

- .1 TABB - Commissioning Manual.**

1.3 COMMISSIONING DESCRIPTION

.1 HVAC commissioning process includes the following tasks:

- .1 Testing and startup of HVAC equipment and systems.**
- .2 Equipment and system verification checks.**
- .3 Assistance in functional performance testing to verify testing and balancing, and equipment and system performance.**
- .4 Provide qualified personnel to assist in commissioning tests, including seasonal testing.**

-
- .5 Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
 - .6 Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
 - .7 Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
 - .8 Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
 - .9 Provide training for systems specified in this Section with coordination by Commissioning Authority.
 - .2 Equipment and Systems to Be Commissioned:
 - .1 New HVAC systems that were installed under this Contract.
 - .3 The following is a partial list of equipment that may be included in this HVAC Commissioning:
 - .1 Pumps.
 - .2 Piping systems.
 - .3 Ductwork.
 - .4 Gas-fired heating ventilating units.
 - .5 Air handling units.
 - .6 Unit heaters.
 - .7 Fans.
 - .8 Testing, Adjusting and Balancing work.
 - .4 Perform seasonal function performance tests for the following equipment and systems:
 - .1 Heating equipment during heating season.
 - .2 Cooling equipment during cooling season.

1.4 COMMISSIONING SUBMITTALS

- .1 Draft Forms: Submit draft of system verification form and functional performance test checklist.
- .2 Test Reports: Indicate data on system verification form for each piece of equipment and system as specified. Use AABC forms as guidelines. Submit data in dual English and metric units.
- .3 Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.5 CLOSEOUT SUBMITTALS

- .1 Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.
- .2 Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.6 QUALITY ASSURANCE

- .1 Perform Work in accordance with ASHRAE Guideline 1 requirements.

1.7 COMMISSIONING RESPONSIBILITIES

- .1 Equipment or System Installer Commissioning Responsibilities:
 - .1 Attend commissioning meetings.
 - .2 Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.
 - .3 Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.
 - .4 Provide instructions and demonstrations for Region Representative's personnel.
 - .5 Ensure subcontractors perform assigned commissioning responsibilities.
 - .6 Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
 - .7 Develop startup and initial checkout plan using manufacturer's startup.

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-
- .8 procedures and functional performance checklists for equipment and systems to be commissioned.
 - .9 During verification check and startup process, execute HVAC related portions of checklists for equipment and systems to be commissioned.
 - .10 Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
 - .11 Provide manufacturer's representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem- solving.
 - .12 Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
 - .13 Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.
 - .14 Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
 - .15 Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
 - .16 Perform verification checks and startup on equipment and systems as specified.
 - .17 Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.
 - .18 Perform operation and maintenance training sessions scheduled by Commissioning Authority.
 - .19 Conduct HVAC system orientation and inspection.
- .2 Temperature Controls Installer Commissioning Responsibilities:
- .1 Attend commissioning meetings.
 - .2 Review design for ability of systems to be controlled including the following:
 - .1 Confirm proper hardware requirements exists to perform functional performance testing.
 - .2 Confirm proper safeties and interlocks are included in design.

-
- .3 Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.
 - .4 Confirm proper sizing of system control dampers and actuators and damper operation will result in proper damper positioning.
 - .5 Confirm sensors selected are within device ranges.
 - .6 Review sequences of operation and obtain clarification from Consultant.
 - .7 Indicate delineation of control between packaged controls and building automation system, listing BAS monitor points and BAS adjustable control points.
 - .8 Provide written sequences of operation for packaged controlled equipment. Equipment manufacturers' stock sequences may be included, when accompanied by additional narrative to reflect Project conditions.
-
- .3 Inspect, check, and confirm proper operation and performance of control hardware and software provided in other HVAC sections.
 - .4 Submit proposed procedures for performing automatic temperature control system point-to- point checks to Commissioning Authority and Consultant.
 - .5 Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
 - .6 Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
 - .7 Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
 - .8 Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
 - .9 Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

.3 Testing, Adjusting, and Balancing Agency Commissioning Responsibilities:

- .1 Attend commissioning meetings.
- .2 Participate in verification of testing, adjusting, and balancing report for verification or diagnostic purposes.
- .3 Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.8 COMMISSIONING MEETINGS

- .1 Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.9 SCHEDULING

- .1 Prepare schedule indicating anticipated start dates for the following:
 - .1 Piping system pressure testing.
 - .2 Piping system flushing and cleaning.
 - .3 Ductwork cleaning.
 - .4 Ductwork pressure testing.
 - .5 Equipment and system startups.
 - .6 Automatic temperature control system checkout.
 - .7 Testing, adjusting, and balancing.
 - .8 HVAC system orientation and inspections.
 - .9 Operation and maintenance manual submittals.
 - .10 Training sessions.
- .2 Schedule seasonal tests of equipment and systems during peak weather conditions to observe full- load performance.
- .3 Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.

1.10 COORDINATION

- .1 Notify Commissioning Authority minimum of four weeks in advance of the following:
 - .1 Scheduled equipment and system startups.
 - .2 Scheduled automatic temperature control system checkout.
 - .3 Scheduled start of testing, adjusting, and balancing work.
- .2 Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Install additional balancing dampers, balancing valves, access doors, test ports, and pressure and temperature taps required to meet performance requirements.
- .2 Place HVAC systems and equipment into full operation and continue operation during each working day of commissioning.
- .3 Install replacement sheaves and belts to obtain system performance, as requested by Commissioning Authority.
- .4 Install test holes in ductwork and plenums as requested by Commissioning Authority for taking air measurements.
- .5 Prior to start of functional performance test, install replacement filters in equipment

3.2 FIELD TESTS AND INSPECTIONS

- .1 Seasonal Sensitive Functional Performance Tests:
 1. Test heating equipment at winter design temperatures.
 2. Test cooling equipment at summer design temperatures.

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- .2 Be responsible to participate in initial and alternate peak season test of systems required to demonstrate performance.
- .3 Occupancy Sensitive Functional Performance Tests:
 - 1. Test equipment and systems affected by occupancy variations at minimum and peak loads to observe system performance.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 RELATED SECTIONS

- .1 Section 01 74 19 – Construction Waste Management and Disposal.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing of HVAC.
- .3 Section 23 25 00 - HVAC Water Treatment.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E202 – Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2 Health Canada / Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Instructions: submit manufacturer's installation instructions.
 - .1 Region's Representative will make available one (1) copy of systems supplier installation instructions.

1.5 QUALITY ASSURANCE

.1 Health and Safety:

- .1 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.**

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading.

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

.2 Waste Management and Disposal:

- .1 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.**

2.0 PRODUCTS

2.1 CLEANING SOLUTIONS

- .1 Low foaming detergent at all temperatures**
- .2 No pH neutralization required**
- .3 Designed for use on most metals including aluminum**
- .4 Bio-degradable**
- .5 Phosphate Free**
- .6 Nitrite Free**

3.0 EXECUTION

3.1 CLEANING HYDRONIC AND STEAM SYSTEMS

.1 Timing

- .1 Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.**

-
- .2 Cleaning Agency:
 - .1 Retain qualified water treatment specialist to perform system cleaning.
 - .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.
 - .4 Cleaning procedures:
 - .1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
 - .1 Cleaning procedures, flow rates, elapsed time.
 - .2 Chemicals and concentrations to be used.
 - .3 Inhibitors and concentrations.
 - .4 Specific requirements for completion of work.
 - .5 Special precautions for protecting piping system materials and components.
 - .6 Complete analysis of water to be used to ensure water will not damage systems or equipment.
 - .5 Conditions at time of cleaning of systems
 - .1 Systems to be free from construction debris, dirt and other foreign material.
 - .2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.
 - .3 Strainers to be clean prior to initial fill.
 - .4 Install temporary filters on pumps not equipped with permanent filters.
 - .5 Install pressure gauges on strainers to detect plugging.
 - .6 Report on Completion of Cleaning
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.7 Hydronic Systems:

- .1 Flush system thoroughly with water, back flush pump, strainers, blow down drain valves and risers to remove all loose debris. Remove accumulated sludge in boilers if necessary.
- .2 Then add 2% solution of low foaming detergent to the system through a by-pass feeder or another feeding device.
- .3 Circulate for 36 hours at 82° C. For chilled systems, circulate at least 48 hours at ambient temperature.
- .4 During recirculation, back flush strainers, drain valves and risers at their lowest point once every 8 hours.
- .5 Drain cleaning water completely.
- .6 Then fill and drain system several times. Circulate 30 minutes every time the system is refilled.
- .7 Bleed system at several points until water is clear and non-foaming. Clean pump strainers.
- .8 Draw a water sample from the system and send it to out laboratory for analysis.
- .9 If the laboratory report is satisfactory, the system must then be treated with the appropriate formula.

3.2 START-UP OF HYDRONIC SYSTEMS

- .1 After cleaning is completed and system is filled:
 - .1 Establish circulation and expansion tank level, set pressure controls.
 - .2 Ensure air is removed.
 - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
 - .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
 - .5 Clean out strainers repeatedly until system is clean.
 - .6 Commission water treatment systems as specified in Section 23 25 00 - HVAC Water Treatment.

- .7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
- .8 Repeat with water at design temperature.
- .9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
- .10 Bring system up to design temperature and pressure slowly over a 48 hour period.
- .11 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing (TAB).
- .12 Adjust pipe supports, hangers, springs as necessary.
- .13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
- .14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.
- .15 Re-tighten bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .16 Check operation of drain valves.
- .17 Adjust valve stem packings as systems settle down.
- .18 Fully open all balancing valves (except those that are factory-set).
- .19 Check operation of over-temperature protection devices on circulating pumps.
- .20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

3.3 CLEANING

- .1 Provide in accordance with Section 01 74 00 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes
 - .1 Materials and installation for piping, valves and fittings for gas fired equipment.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 01 43 00 – Quality Control.
- .5 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .6 Section 23 05 15 - Common Installation Requirements for HVAC Pipework.
- .7 Section 23 08 01 – Performance Verification Mechanical Piping Systems.
- .8 Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

1.3 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.5, Pipe Flanges and Flanged Fittings
 - .2 ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings
 - .3 ASME B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
 - .4 ASME B18.2.1, Square and Hex Bolts and Screws Inch Series.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 47/A47M, Standard Specification for Ferritic Malleable Iron Castings.

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- .2 ASTM A 53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B 75M, Standard Specification for Seamless Copper Tube (Metric).
 - .4 ASTM B 837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
 - .3 Canadian Standards Association (CSA International).
 - .1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
 - .4 Canadian Standards Association (CSA) / Canadian Gas Association (CGA).
 - .1 CAN/CSA B149.1HB, Natural Gas and Propane Installation Code Handbook.
 - .2 CAN/CSA B149.2, Propane Storage and Handling Code.
 - .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fitting and equipment.
 - .2 Indicate on manufacturer's catalogue literature following: valves.
 - .3 Submit WHMIS SDS in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's for adhesive and solvents during application and curing.
 - .4 Test Reports: Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

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- .5 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .6 Instructions: Submit manufacturer's installation instructions.
 - .7 Closeout Submittals: Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Pre-Installation Meeting:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify Project requirements.
 - .2 Review Installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.
- .3 Trades people to have journey person qualifications.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

- .4 Separate for reuse and recycling and place in designated containers, steel, metal, plastic waste in accordance with WMP.
- .5 Divert unused metal materials from landfill to metal recycling facility as approved by Region's Representative.

2.0 PRODUCTS

2.1 PIPE

- .1 Steel pipe: to ASTM A 53/A53M, Schedule 40, seamless as follows:
 - .1 NPS ½ to 2, screwed.
 - .2 NPS 2 ½ and over, plain end.
- .2 Copper pipe: to ASTM B 75M.

2.2 JOINTING MATERIAL

- .1 Screwed fittings: pulverized lead paste
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: non-metallic flat.
- .4 Brazing: to ASTM B 75M.

2.3 FITTINGS

- .1 Steel pipe fittings, screwed:
 - .1 Malleable iron: screwed to ANSI B16.3, Class 150 for service pressures up to and including 861 kPa.
 - .2 Unions: malleable iron, brass to iron, ground seat, to ASTM A47M.
 - .3 Nipples: schedule 40, to ASTM A53.
- .2 Copper tube fittings:
 - .1 Service line riser and transition fittings.
 - .1 Wrought copper and copper alloy, solder type 1 to ANSI/ASME B16.22.

2.4 MANUAL SHUT-OFF VALVES

- .1 NPS 4 and under, full port, forged brass ball valve for two piece body construction complete with the following:
 - .1 Blowout-proof stem.
 - .2 Adjustable packing gland.
 - .3 Chrome-plated ball.
 - .4 Class 150 WSP, 600 WOG.
 - .5 CGA 3.16 approved.
 - .6 Provide complete with CRN.
 - .7 Lever handle.
 - .8 ANSI B1.20.1 NPT end connections.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PIPING

- .1 Install piping in accordance Section 23 05 15 - Common Installation Requirements for HVAC Pipework, applicable Provincial Codes, CAN/CSA-B149.1, supplemented as specified.
- .2 Slope piping down in direction to flow to low points.
- .3 Install drip points:
 - .1 At low points in piping system and where indicated.
 - .2 Provide complete with blowdown valve i.e. manual shut-off valve as specified above.

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- .3 Minimum 75 mm in length from tee connection in riser to top of valve. Size to be minimum NPS $\frac{3}{4}$. Provide complete with threaded end cap.
 - .4 Use eccentric reducers at pipe size change installed to provide positive drainage.
 - .5 Provide clearance for access and for maintenance.
 - .6 Ream pipes, clean scale and dirt, inside and out.
 - .7 Install piping to minimize pipe dismantling for equipment removal.
 - .8 Field ending of piping to be prohibited.
 - .9 Nesting of bushings to be prohibited. Utilize properly sized reducing fittings.
 - .10 Do not utilize propane piping as an electrical ground.

3.3 VALVES

- .1 Install valves with stems upright or horizontal unless approved otherwise by Region's Representative.
- .2 Install valves as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system in accordance with CAN/CSA B149.1 and CAN/CSAB149.2 and requirements of authorities having jurisdiction.
- .2 Manufacturer's Field Services:
 - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with contract.
 - .2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
 - .3 Schedule site visits to review work at stages listed:

-
- .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of work at 25% and 60% complete.
 - .3 Upon completion of work, after cleaning is carried out.
 - .3 Obtain reports within three (3) working days of review and submit immediately to Region's Representative.
 - .4 Performance Verification:
 - .1 Refer to Section 23 08 01 – Performance Verification of Mechanical Piping Systems.
 - .5 PV procedures:
 - .1 Test performance of components.

3.5 ADJUSTING

- .1 Purging: purge after pressure test in accordance with CAN/CSA B149.1 and CAN/CSA B149.2.
- .2 Pre-Start-Up Inspections:
 - .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
 - .2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.6 CLEANING

- .1 Cleaning: in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems, CAN/CSA B149.1, CAN/CSA B149.2, supplemented as specified.
- .2 Perform cleaning operations as specified in Section 01 74 00 – Cleaning, and in accordance with manufacturer's recommendations.
- .3 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 Related Work

- .1 This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Reference Standards

- .1 Do piping system work in accordance with ASME/ANSI B31.9 code and CSA B51.
- .2 Grooved joint piping components shall conform to CSA B242 code.

1.3 Regulatory Requirements

- .1 Components, products and fabrication techniques shall be provided in compliance with Regulations and Requirements of Province of Ontario Technical Standards & Safety Authority (TSSA).
- .2 Installation, repair or alternations to pressure piping systems shall be performed by licensed Contractors Welders, certified for work in accordance with Regulations and Requirements of Province of Ontario Technical Standards & Safety Authority (TSSA).
- .3 Field welding to be in accordance with procedures of CSA-W117.2 and current edition of ASME/ANSI B31.1 or B31.9 Code.

1.4 System Pressure Ratings

- .1 Pipe Fittings:
 - .1 Piping system 860 kPa or less operating pressure – 860 kPa rating.
 - .2 Piping systems 870 kPa to 1,725 kPa operating pressure – 1730 1,725 kPa rating.
- .2 Valves:
 - .1 Suitable for maximum system operating temperature and pressure.

1.5 Shop Drawings

- .1 Submit detailed shop drawings of valves in accordance with Section 23 05 00 – Common Work Results for HVAC. Shop drawings shall indicate make, model, location, type, size and pressure rating and Provincial CRN number.

- .2 Grooved joint couplings and fittings shall be shown on drawing and product submittals and shall be specifically identified with the applicable style or series designation.

2. PRODUCTS

2.1 General

- .1 Products shall be registered with regulatory authority in accordance with CSA B51.

2.2 Pipe

.1 Steel Pipe:

- .1 To NPS 10, Schedule 40 to ASTM A53 Grade B or NPS 3/4 to NPS 2 to ASTM A795, Schedule 5, suitable for Pressfit.
- .2 To NPS 12 and over, 9.5 mm wall thickness to ASTM A53 Grade B.
- .3 For the following system:
 - .1 Hot water heating.
 - .2 Chemical feed.
 - .3 Relief valve vents.
- .2 Stainless Steel Pipe: To NPS 2, Schedule 10S to ASTM A312, Type 304/304L, suitable for and approved for use with Vic-Press 304™.
- .3 Copper Pipe: to ASTM B88M-86, Type K, or L hard drawn copper tubing.

.1 Type L, hard drawn:

- .1 Pressure drains (to NPS 2).
- .2 Type L hard drawn may be used as an alternative to steel piping for the following systems:
 - .1 Hot water heating.
- .3 Type K, hard drawn:
 - .1 Air vent overflow

2.3 Pipe Joints – Steel Piping

- .1 NPS 2 and under: screwed fittings, except where otherwise noted, with Teflon tape and RectorSeal Teflon paste or pipe dope, Pressfit in applicable applications.
 - .2 NPS 2-1/2 and over: welding fittings and flanges to CSA W47.1.
 - .3 Flanges: raised face, steel weld neck, lap or back-welded slip on type. Use flat face for attachment to cast iron valves.
 - .4 Victaulic Pressfit fittings with grade “E” EPDM O-rings may be used on hot water heating up to 110°C working temperature, and 200 psig working pressure glycol heating, glycol heat recovery, chilled water, heat pump water, condenser water-closed circuit systems.
 - .5 Victaulic couplings or SHURJOINT brand to CSA B242-M1980 may be used on hot water heating, chilled water, condenser water, glycol heat recovery and heat pump water systems. Use lubricant supplied by Manufacturer and coat gasket. Grade “EHP” gasket for temperature range -34°C to 120°C or “EPDM” gasket for temperature range -34°C to 110°C. Couplings shall consist of two ductile iron housing segments conforming to ASTM A536 Grade 65-45-12.
-
- .1 Rigid Type to NPS 12: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.
 - .1 NPS 2 through NPS 8: Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to 120°C. Victaulic Style 107H.
 - .2 Victaulic Zero-Flex Style 07.
 - .2 Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of flexible connector provided it meets vibration isolation requirements. The couplings shall be placed in close proximity to the source of the vibration. Victaulic Style 77 or Installation-Ready Style 177.
 - .3 NPS 14 and Larger: Victaulic AGS series with lead-in chamfer on housing key and wide width FlushSeal® gasket.
 - .1 Rigid Type: Housing key shall fill the wedge shaped AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07.
 - .2 Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular pipe movement. Victaulic Style W77.

- .4 Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741 / W741.
- .1 For connections to Class 300 flanged components in sizes through NPS 12, Victaulic Style 743.
- .6 Flange Bolts and Nuts, carbon steel: to ANSI B18.2.1 and ANSI B18.2.2.
- .7 Flange gaskets:
 - .1 Up to 860 kPa system pressure – non-asbestos gaskets for mating surfaces.
 - .2 Over 860 kPa system pressure – stainless steel spiral wound non-asbestos gaskets.

2.4 Pipe Fittings – Steel Pipe

- .1 Pipe fittings, screwed, flanged or welded:
 - .1 Cast-iron pipe flanges: Class 125 to ANSI B16.1.
 - .2 Cast-iron screwed fittings: Class 125 to ANSI B16.3.
 - .3 Steel pipe flanges and flanged fittings: to ANSI B16.5.
 - .4 Steel butt-welding fittings: to ANSI B16.9a.
 - .5 Unions, malleable iron ground joint type: Class 150 to ANSI B16.3.
- .2 Fittings for roll grooved piping: Ductile iron to ASTM A536; wrought steel to ASTM A234 Grade WPB; or factory fabricated from steel pipe conforming to ASTM A53.
 - .1 All grooved joint couplings, fittings, valves, and specialties shall be Victaulic.
 - .2 Grooving tools shall be of the same Manufacturer as the grooved components.
 - .3 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

2.5 Pipe Joints – Stainless Steel Pipe

- .1 Victaulic Vic-Press 304™ fittings with HNBR O-rings may be used on hot water heating up to 98°C working temperature, domestic water, glycol heating, glycol heat recovery, chilled water, heat pump water, condenser water-closed circuit systems. Vic-Press system shall be rated to 3,450 kPa.

2.6 Pipe Joints – Copper Pipe

- .1 All sizes soldered or brazed as specified in Part 3 Execution of this Section.
- .2 NPS 2 to NPS 8 – Victaulic Style 607 installation-ready rigid copper couplings with offsetting angle-pattern bolt pads and grade “EHP” gasket for temperature range - 34°C to 120°C may be used on hot water heating, heat pump, chilled water, and condenser water systems.
 - .1 Couplings shall be manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)

2.7 Pipe Fittings – Copper Pipe

- .1 Cast bronze: to ANSIB16.18.
- .2 Wrought copper bronze: to ANSIB16.22.
- .3 Roll grooved (non-flared) fittings by Victaulic.

2.8 Flanges – Copper Pipe

- .1 Brass or bronze: to ANSIB16.15.
- .2 Cast-iron: to ANSIB16.4.
- .3 Victaulic Style 641 Flange Adapter.

2.9 Valves General

- .1 Valves shall be of one Manufacturer.
- .2 Provide valves with Manufacturer’s name and pressure rating clearly marked on outside of body. Valves shall be suitable for service used.
- .3 All castings used for valve bodies shall be date stamped for quality assurance and traceability.
- .4 Valves shall have current Provincial CRN number.
- .5 Include lock shield handles where shown or noted.
- .6 Provide valves located over 2.1 m from floor in equipment room areas with chain operated sheaves. Extend chains to 1.8 m above floor and hook to clips arranged to clear walking aisles.
- .7 Use non-rising stem valves where there is insufficient clearance for stem to rise.

- .8 Butterfly valves installed to permit removal of equipment, shall be threaded full lug type or grooved. Wafer type if additional pair of flanges is installed. The stem on butterfly valves shall be offset from the disc centerline to provide full 360-degree circumferential seating.

2.10 Gate Valves

- .1 NPS 2 and under, screwed:
 - .1 Bronze body, rising stem, solid wedge disc, union or screwed bonnet.
 - .2 Acceptable Products:
 - .1 860 kPa – Crane 1700, Grinnell 3010, Kitz 24, Newman Hattersley 607, Nibco T-134, Toyo 293.
- .2 NPS 2 and under, soldered:
 - .1 Bronze body, rising stem, solid wedge disc, screwed bonnet.
 - .2 Acceptable Products:
 - .1 1,380 kPa WOG – Crane 1700S, Grinnell 3080SJ, Kitz 44, Newman Hattersley 607C, Nibco S-134, Toyo 299.
- .3 NPS 2-1/2 and over, flanged:
 - .1 Cast-iron body, rising stem, OS and Y, solid wedge disc, bronze trim, bolted bonnet.
 - .2 Acceptable Products:
 - .1 860 kPa – Crane 465-1/2, Grinnell 6020A, Kitz 72, Newman Hattersley 504, Nibco F-617-0, Toyo 421A.

2.11 Globe Valves

- .1 NPS 2 and under, screwed:
 - .1 Bronze body, rising stem, renewable composition or bronze disc, union bonnet.
 - .2 Acceptable Products:
 - .1 860 kPa – Crane 1703, Grinnell 3240, Kitz 03, Newman Hattersley 14, Nibco T-235-Y, Toyo 220.
- .2 NPS 2 and under, soldered:

- .1 Bronze body, rising stem, renewable composition or bronze disc, screwed bonnet.
- .2 Acceptable Products:
 - .1 1,380 kPa W.O.G. – Crane 1703S, Grinnell 3240SJ, Kitz 10, Newman Hattersley 51, Nico S-211-YW, Toyo 212.

2.12 Butterfly Valves

- .1 NPS 2-1/2 and over:
 - .1 Cast-iron and ductile iron body with ductile iron plated or bronze disc, stainless steel stem and extended neck to clear minimum of 50 mm thick insulation.
 - .2 Threaded full lug type or wafer type (with or without integral flanges).
 - .3 Resilient EPT or EPDM seat.
 - .4 Operators (unless otherwise specified in Controls Section):
 - .1 NPS 8 and under – lever handle with minimum 10 position ratchet and disc position indicator.
 - .2 NPS 10 and over – worm gear operator.
 - .5 Acceptable Products:
 - .1 1,034 kPa WOG – Crane, Centreline, Demco, Dezurik, Grinnell, Keystone, Kitz, Kurimoto, Newman Hattersley, Nibco WD-2100 or LD- 2100, Norriseal, Apollo 141 or 143.
- .2 NPS 2 and over – Steel roll grooved piping:
 - .1 Ductile iron body.
 - .2 Disc:
 - .1 Electroless nickel or PPS coated ductile iron.
 - .2 Aluminum bronze.
 - .3 Stainless steel.
 - .3 Seal:
 - .1 NPS 12 and Smaller: Pressure-responsive Grade ‘E’ – EPDM.
 - .2 NPS 14 and Larger: Disc-mounted Grade ‘E’ – EPDM.

- .4 Stainless steel stem. (Stem shall be offset from the disc centreline to provide full 360-degree circumferential seating.)
- .5 Grooved ends.
- .6 Operators (unless otherwise specified in the Controls Section):
 - .1 NPS 8 and under – lever handle with minimum 10 position ratchet and disc position indicator.
 - .2 NPS 10 and over – worm gear operator.
- .7 Acceptable Products:
 - .1 1,070 kPa WOG –
 - 1. NPS 12 and Smaller: Victaulic MasterSeal™.
 - 2. NPS 14 and Larger: Victaulic AGS-Vic300.
- 3. NPS 2-1/2 through NPS 6 – Copper roll grooved (non-flared) piping:
 - 1. Cast bronze body.
 - 2. Disc: Ductile iron encapsulated with Grade ‘E’ EPDM.
 - 3. Stem: Integrally cast to the disc.
 - 4. Copper-tube dimensioned grooved ends.
 - 5. Operator: lever handle with minimum 10 position ratchet and disc position indicator.
 - 6. Acceptable Products:
 - 1. 1,070 kPa WOG – Victaulic Series 608.

2.13 Ball Valves

- .1 NPS 2 and under, screwed:
 - .1 Forged brass body, threaded cap, chrome ball, PTFE seats, blow-out proof stem.
 - .2 Ball valves for isolation service shall have large/full port.
 - .3 Ball valves for balancing service shall have reduced port and memory stop valve handle.

.4 Acceptable Products:

- .1 4,140 kPa WOG – Crane F9202, Grinnell 3700, Kitz 58, Newman Hattersley 1969, Nibco T-585-70, Toyo 5044A, Victaulic 722.
- .2 Victaulic Series P589 / P569 shall be used in when Vic-Press 304™ / Pressfit® fittings are used.

.2 NPS 2 and under, soldered:

- .1 Forged brass body, threaded cap, chrome-plated ball, PTFE seats.
- .2 Ball valves for isolation service shall have large/full port.
- .3 Ball valves for balancing service shall have reduced port and memory stop valve handle.

.4 Acceptable Products:

- .1 3,450 kPa WOG – Crane F9222, Grinnell 3700SJ, Kitz 59, Newman Hattersley 1979, Nibco S-585-70, Toyo 5049A.

2.14 Balance Fittings and Valves

.1 NPS 1-1/4 and under:

- .1 Bronze body and bronze trim, rising stem, renewable composition disc, globe type with memory stop, Lockshield, male union connections, angle and straight type.

.2 Acceptable Products:

- .1 690 kPa – Dahl 13000-M series, Toyo 250 or 251.
- .2 NPS 1-1/2 and over:

.2 Screwed connections up to NPS 2.

- .1 Flanged connections NPS 2-1/2 and over.
- .2 Cast-iron body, non-lubricated eccentric plug with resilient coating EPT or RS 55, suitable for 120°C operating temperature, stainless steel bearings, adjustable memory stop, plug type suitable for wrench adjustment.

.3 Acceptable Products:

- .1 1,210 kPa WOG – DeZurik 400, Keystone Ballcentric.

.2 NPS 3 and over:

.1 Victaulic Vic-Plug Valve Series 377.

2.15 Automatic Flow Control Valves

.1 General: Devices shall automatically control required flow quantity between differential pressure ranges of 0 kPa to 310 kPa (pressure independent type auto-flow valves).

.2 NPS 2 and smaller:

.1 Body forged brass ASTM B283 600 WOG, 163°C.

.2 Return from coil: (downstream side of Temperature Control Valve) Combination assembly including:

.1 Body fitted with ball shut-off valve, hard chrome-plated, Teflon Ball Seals and Viton O-Rings.

.2 Flow Cartridge shall be accessible non-clogging piston type with $\pm 5\%$ accuracy.

.3 Two P/T Plugs, union for accepting temperature control valve (by Controls Contractor).

.3 Return from Coil: (upstream side of Temperature Control Valve) Combination assembly including:

.1 Fullport union with manual air vent and P/T test plug.

.4 Supply to coil: Combination assembly including:

.1 Ball valve, strainer P/T test plug and blow down drain valve.

.3 NPS 2-1/2 and larger:

.1 Body epoxy coated ductile iron ASTM A536 2,760 kPa 177°C.

.2 Flow cartridges 304 SS moving parts in brass housing, 14 kPa to 310 kPa, 1.9 L/s to 144 L/s.

.3 P/T Plugs, thermometer well and drain.

.4 Provide dual hose temperature/pressure meter kit with flow conversion chart and carrying case.

- .5 Acceptable Products: Nexus, Griswold, Victaulic Series 76V/76G.

2.16 Circuit Balancing Valves

- .1 NPS 2 and under: copper alloy body, screwed, ‘Y’ patter globe.
- .2 NPS 2-1/2 and over: Ductile-iron body, flanged or grooved, ‘Y’ patter globe.
- .3 Maximum pressure 1,725 kPa and maximum temperature 120°C.
- .4 Calibrated balancing valve with memory, positive shut-off, inlet and outlet pressure measuring connections with integral shut-offs and drains.
- .5 Calibration charts and adjustment tools to be included.
- .6 Provide differential pressure meter kit of same brand and Manufacturer as balancing valves, suitable for direct read-out complete with connection hoses suitable for system pressure. Meter to remain with Region’s Representative after installation.
- .7 Acceptable Products:
 - .1 Bell and Gossett – Circuit Setter
 - .2 ESBE – Circuit Setter
 - .3 Victaulic / Tour and Anderssen – STAD, STAF, and STAG
 - .4 Armstrong – CBV
 - .5 Wheatley – GS
 - .6 Nexus
- .8 Packaged coil components consisting of required coil valving, strainers, unions, hoses, etc., may be supplied. Victaulic Koil-Kit Series 799 or 79V, with Series 78U Union Port Fitting, Series 78Y Strainer/Ball Valve, Series 78T Union/Ball Valve, required 600 mm long braided hoses, and Series 793/794 Differential Pressure Controllers. The coil package shall be provided with a meter to be left with the Region’s Representative after installation.

2.17 Swing Check Valves

- .1 NPS 2 and under, screwed:
 - .1 Bronze body, bronze swing disc, screw in cap, regrindable seat.
 - .2 Acceptable Products:

- .1 860 kPa – Crane 1707, Grinnell 3300, Kitz 22, Newman Hattersley 60, Nibco T-413-B, Toyo 236.
- .2 NPS 2 and under, soldered:
 - .1 Bronze body, bronze swing disc, screw in cap, regrindable.
 - .2 Acceptable Products:
 - .1 Class 1,380 kPa WOG – Crane 1707S, Grinnell 3300SJ, Kitz 23, Newman Hattersley 61, Nibco-S-413-B, Toyo 237.
- .3 NPS 1-1/2 and over, grooved:
 - .1 Ductile iron body, Grade ‘E’ – EPDM seat, stainless steel swing disc, coupled cap.
 - .2 Acceptable Products:
 - 1. Class 1,070 kPa CWP – Victaulic Style 712.
- .4 NPS 2-1/2 and over, flanged:
 - .1 Cast-iron body, renewable or regrindable seat, bronze swing disc, bolted cap.
 - .2 Acceptable Products:
 - 1. Class 860 kPa – Crane 373, Grinnell 6300A, Kitz 78, Newman Hattersley 731, Nibco F-918, Toyo 435A.

2.18 Silent Check Valves (Spring Type)

- .1 NPS 2 and under, screwed:
 - .1 Bronze body, bronze trim, stainless steel spring, (heavy duty spring in vertical down flow application).
 - .2 Acceptable Products:
 - .1 860 kPa – Conbraco 61-500, Durabla, Grinnell 3600, Muessco 203BP.
- .2 NPS 2-1/2 and over:
 - .1 Cast steel, wafer style bronze trim, stainless steel spring (heavy duty spring in vertical down flow application).
 - .2 Cast ductile iron, grooved end type, stainless steel spring and shaft, for use in horizontal or vertical applications.

.3 Acceptable Products:

- .1 860 kPa – Apco, Centerline, Durabla, Duo-Chek II, Grinnell CV817, Nibco W-910, M & G, Victaulic 716, 779.
- .2 1,070 kPa with Grooved Ends: Victaulic 716, or 779 with venturi taps.
 - 1. For sizes NPS 14 and over, Class 230 psi with AGS grooved ends, Victaulic Series W715.

2.19 Combination Balance/Check Valves

- .1 Integrated shut-off, non-slam check valve and balance valve.
- .2 Suitable for 1,034 kPa and 120°C.
- .3 Cast-iron body, stainless steel trim, bronze seat and disc.
- .4 Connections:
 - .1 NPS 2 and under, screwed.
 - .2 NPS 2-1/2 and over; flanged or grooved Victaulic.
- .5 Select for system flow rate, and allowable pressure drop at velocity not exceeding 1.8 m/s.
- .6 Acceptable Products:
 - .1 Armstrong Flo Trex, Bell & Gossett Triple Duty, Taco Multi-purpose, Victaulic triple service valves.

2.20 Needle Valves

- .1 Bronze body, screwed, globe type with cadmium plated steel stem.
- .2 Acceptable Products:
 - .1 Class 2,760 kPa – Crane 88/89, RPandC 60-100.
- .3 Application: Install needle valves where petcocks or manual vents are indicated.

2.21 Radiator Valves

- .1 Screwed bronze body with bronze trim, wheel handle, rising stem, renewable composition disc, male union connections, angle and straight type.

.2 Acceptable Products:

- .1 Class 690 kPa – Dahl 11041 or 11042, Dunham Bush 200B or 246B, Kitz 100 series, Sarco Type R or RP, Toyo 252 or 253.

2.22 Drain Valves

- .1 Globe type, bronze body with bronze trim and composition disc.

.2 Acceptable Products:

- .1 Crane 1703. Dahl 2343, Kitz 03, Newman Hattersley 13, Nibco T-235-Y, Toyo 220.

.3 EXECUTION

3.1 Piping

- .1 Ream pipe ends. Clean scale and dirt, inside and outside before and after assembly. Remove welding slag or other foreign material from piping.
- .2 During construction, protect openings in piping and equipment, by capping or plugging to prevent entry of dirt.
- .3 Screw, weld or groove (unless otherwise specified) piping systems up to NPS 2.
- .4 Weld or groove (unless otherwise specified) all piping systems NPS 2-1/2 and over.
- .5 Install piping to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.
- .6 Avoid piping in exterior walls unless otherwise directed. If required, install this piping protected from outside by building insulation and vapour barrier.
- .7 Maintain minimum of 25 mm space between adjacent flanges or pipe insulation, whichever has larger diameter.
- .8 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .9 Saddle type branch fittings may be used on mains, if branch line is half size or smaller than main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle. Use correct hole saw size for Victaulic 920 Mechanical tees.
- .10 If welding, use long radius elbows.

- .11 Install thermometer wells and immersion sensor wells specified under Controls Section. Where wells restrict flow in small diameter pipes (NPS 1-1/2 and smaller) install section of oversized pipe at least NPS 2.
- .12 Remake leaking joints using new materials, do not caulk or cement leaking threaded joints.
- .13 Use eccentric reducers at pipe size changes, flush on top side, to permit positive venting and drainage.
- .14 Do not use thread protection couplings, close nipples, running nipples or street elbows.
- .15 Install di-electric type unions or flanges or Victaulic Style 47 Clearflow Di-electric Waterways to “OPEN” type systems, where copper piping connects to steel. E.g. Domestic hot water tanks.
- .16 Avoid locating water and drain piping over electrical equipment.
- .17 Where unavoidable, provide galvanized drip pans under such pipe and weld piping and fittings. Provide drain and piping from drip pans to floor drain.
- .18 Bull head tees shall not be used for converging flows.

3.2 Pipe Grading

- .1 Grade piping to provide positive drainage and venting. Slope as follows:
 - .1 Supply mains and branches – up in direction of flow, minimum 1:480 [25 mm in 12 m].
 - .2 Return mains and branches – down in direction of flow, minimum 1:480 [25 mm in 12 m].
 - .3 Reverse return supply and return mains – up in direction of flow, minimum 1:480 [25 mm in 12 m].
 - .4 Grade horizontal drainage and vent piping down in direction of flow, 2% minimum.
 - .5 On closed system, equip low points with 19 mm drain valves. Provide at high points on lines and equipment connections, collecting chambers and high capacity float operated air vents.

3.3 Grooved Joint Piping Systems:

- .1 Grooved joints shall be installed in accordance with Manufacturer’s latest published installation instructions.

- .2 Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
- .3 Gaskets shall be elastomer grade suitable for intended service, and be molded and produced by coupling Manufacturer.
- .4 Grooved coupling Manufacturer's factory trained Representative shall provide on-site training for Contractor's field personnel in use of grooving tools and installation of grooved joint products.
- .5 Representative shall periodically visit jobsite and review Contractor is following best recommended practices in grooved product installation. (Distributor's Representative is not considered qualified to conduct training or jobsite visit(s).)

3.4 Soldering and Brazing

- .1 Pressure fluid systems – with chemical treatment (heating, chilled and condenser water) BRAZE with silver base brazing alloy, 538°C melting point.
- .2 Pressure fluid systems – without chemical treatment, (heat recovery, domestic water) SOLDER with 95/5 tin- antimony.
- .3 Non-pressure systems, (drains) SOLDER with 50/50 tin lead.
- .4 Piping connections to radiant ceiling panels, SOLDER with 95/5 tin-antimony.

3.5 Drain Connections

- .1 Pipe discharge from liquid relief valves, liquid safety valves, high capacity air vents, steam drip pan elbows, equipment blowdown, water columns, overflows and piping system drains to nearest building drain. Install brass, bronze or copper receiving funnel on drain where shown.
- .2 Drains for drain pans shall be DWV copper ASTM B306 32 mm minimum size.
- .3 Drain and vent piping shall be of same material as piping system connected, except where otherwise specified.
- .4 Where item being drained is under pressure, provide deep seal trap.

3.6 Expansion of Piping

- .1 Install piping systems with due regard and provision for expansion, avoiding strain or damage to equipment and building. Provide adequate expansion and contraction for piping running across building expansion joints.

- .2 Only major expansion configuration and fittings have been indicated on drawings. Provide required additional compensators, loops and swing connections.
- .3 Where expansion loops are required, use Victaulic Style 177 and 77 couplings on the loops in accordance with Victaulic instructions and as approved by the Engineer is acceptable.
- .4 Provide anchors, where shown. Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B3.31.
- .5 Expansion loops shall be welded construction with long radius elbows.
- .6 Install expansion loops, cold sprung 50% of calculated expansion.
- .7 Install at least three elbows in branch connections. Where space does not permit, install braided flexible pipe connectors in accordance with Manufacturer's recommendations. Three elbow branch connections shall have sufficient developed length to ensure excessive stresses are not generated in piping and in no case less than 914 mm.

3.7 Valves

- .1 Install valves with stems upright or angled 45° above horizontal unless approved otherwise.
- .2 Install control valves with stems upright unless approved otherwise and with adequate clearance for removal of actuators.
- .3 Use gate valves or ball valves NPS 2 and under to shut-off branch takeoffs and to isolate equipment.
- .4 Butterfly valves may be used as alternative to gate valves on glycol heating, hot water heating, chilled water, condenser water, heat pump and glycol heat recovery systems.
- .5 Use globe valves to control flow in circuits except where balancing cocks are specifically specified.
- .6 Use plug type globe valves in control valve bypass connections.
- .7 Use plug cocks for balance valves in water return branch mains and branch connections to return mains and for shut-off and balancing on glycol circuits.
- .8 Install balance fittings or valves in return piping connections to each terminal heating and cooling unit, e.g. Radiators, unit heaters, fan coil units, heating and cooling coils.

- .9 Install radiator valves in supply connections to each convection heating element.
- .10 Provide isolation valves in systems such that floor by floor for horizontal systems, risers in vertical system and zone areas on large horizontal system can be isolated.
- .11 Provide valves upstream of meters, gauges, automatic air vents, Flowtrex/Triple duty valves, etc. for isolation purposes.
- .12 Use swing check valves, in horizontal and vertical upflow pipes and on discharge of pumps.
- .13 Spring loaded water check valves shall be located 8 pipe diameters downstream of pumps or elbows.
- .14 Use silent check valves where specifically shown in vertical pipes with downward flow.

3.8 Drain Valves and Hose Bibbs

- .1 Install drain valves and hose bibbs at each low point in piping system and at specific drain locations indicated on drawings.
- .2 Install NPS 3/4 hose bibbs at downfed terminal heating and/or cooling units.
- .3 Install NPS 1-1/2 or NPS 3/4 on line sizes less than NPS 1-1/2 drain valves/hose bibbs at low points in piping systems to facilitate draining.
- .4 Install drain valves in lieu of hose bibbs for systems operating at over 93°C.
- .5 Install hose end adaptor on discharge side of each drain valve or pipe to drain, where indicated.
- .6 Use NPS 1-1/2 fire hose and connect to discharge side of drain valves to flush piping system during pipe cleaning process.
- .7 Install caps, with chains, on hose end adaptors, in public areas.

3.9 Piping Tests

- .1 Notify Consultant and Inspection Authority Having Jurisdiction, 48 hours in advance of intended test dates.
- .2 Before testing piping, isolate equipment, which cannot withstand test pressure.
- .3 Do not insulate, backfill or conceal until tests have been completed and approved by inspection authorities.

- .4 Examine systems under test for leaks.
- .5 Joints shall remain dry during test. General sweating around weld shall be reason for rejection.
- .6 Remake leaking connections and joints.
- .7 Tests shall be limited to new piping only.
- .8 New connections to existing piping shall be warranted.
- .9 Do not backfill any underground piping until it has been surveyed and documented by the Region's Representative.
- .10 Initial Hydrostatic test:
 - .1 150% of working pressure, but not less than 860 kPa for 1 working day.
- .11 Final Hydrostatic test:
 - .1 150% of working pressure, after piping connections to equipment are complete, maintain until entire piping system has been inspected.

3.10 Flushing and Cleaning

- .1 Flushing and cleaning shall commence after piping tests are completed.
- .2 Install temporary bypass connections around heat pump units before commencing chemical cleaning.
- .3 Chemically clean the following piping systems as recommended by approved professional chemical cleaning and treatment agency who shall supervise work:
 - .1 Heating hot water system(s).
- .4 Flush out traces of chemical with clean water after chemical cleaning is complete.
- .5 Install final connections to heat pump units after flushing is complete.
- .6 Remove, clean and reinstall strainer baskets.
- .7 Submit report signed by principal of Agency, which certifies cleaning has been satisfactorily completed.

3.11 Chemical Treatment

- .1 Chemically treat water systems in accordance with Section 23 25 00 – HVAC Water Treatment.

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Piping Valves and
Fittings

3.12 Testing and Balancing

- .1 Balance piping systems in accordance with requirements of Section 23 05 93 – Testing, Adjusting and Balancing.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes.
 - .1 Materials and installation for steel piping, valves and fittings for hydronic systems in building services piping.

1.2 RELATED SECTIONS.

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 22 05 00 –Plumbing General.
- .5 Section 23 05 15 - Common Installation Requirements for HVAC Pipework.
- .6 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .7 Section 23 07 13 – Duct Insulation.
- .8 Section 23 07 19 – HVAC Piping Insulation.
- .9 Section 23 08 01 - Performance Verification of Mechanical Piping Systems.
- .10 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.3 REFERENCES

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
 - .2 ASME B16.3, Malleable Iron Threaded Fittings: Classes 150 and 300.
 - .3 ASME B16.5, Pipe Flanges and Flanged Fittings: NPS through NPS 24 Metric/Inch Standard.
 - .4 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.
 - .5 ASME B18.2.1, Square Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange. Loded Head and Lag Screws (Inch Series).

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- .6 ASME B18.2.2, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
 - .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM A536, Standard Specification for Ductile Iron Castings.
 - .4 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .6 ASTM E202, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
 - .3 Canadian Standards Association (CSA International).
 - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
 - .4 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67, Butterfly Valves.
 - .2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71, Cast Iron Swing Check Valves Flanged and Threaded Ends.
 - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.
 - .6 Province of Ontario Boiler, Pressure Vessel and Compressed Gas Regulations.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Closeout Submittals.

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals, and include the following:

- .1 Special servicing requirements.

- .3 Grooved joint couplings and fittings to be indicated on product submittals and to be specifically identified with the applicable style or series designation.
- .4 Grooved products manufacturer to supply on site tools and products for installation training.
- .5 All grooved products to be of one manufacturer.
- .6 Groove products to have current CRN numbers.

1.5 QUALITY ASSURANCE

- .1 Health and Safety.
 - .1 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal.
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Fold up metal and plastic banding, flatten and place in designated area for recycling.

1.7 MAINTENANCE

- .1 Extra Materials.
 - .1 Provide following spare parts:
 - .1 Valve seats: one for every ten valves, each size. Minimum one.
 - .2 Discs: one for every ten valves, each size. Minimum one.

- .3 Stem packing: one for every ten valves, each size. Minimum one.
- .4 Valve handles: two of each size.
- .5 Gaskets for flanges: one for every ten flanges.

2.0 PRODUCTS

2.1 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Grade B as follows:
 - .1 To NPS 6: schedule 40.
 - .2 NPS 8 and 10: schedule 40.
 - .3 NPS 12 and over, 10 mm wall thickness.

2.2 PIPE JOINTS

- .1 NPS 2 and under: screwed fittings with PTFE tape or lead-free pipe dope.
- .2 NPS 2-1/2 and over: welding fittings and flanges to CAN/CSA W48.
- .3 Roll grooved: rigid coupling to CSA B242.
- .4 Flexible couplings to CSA B242 to be used where noted on drawings and on elbows utilized on expansion joints.
- .5 Flanges: plain ASME, B16.1, raised face, slip-on or weld neck to ASME B16.5.
- .6 Orifice flanges: slip-on raised face, 2100 kPa.
- .7 Flange gaskets: to AWWA C111.
- .8 Pipe thread: taper.
- .9 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.
- .10 Roll grooved coupling gaskets: NPS 2 to 8, type EHP, EPDM high performance, -40°C to +120°C for continuous operation, NPS 10 and above type EPDM, -30°C to +110°C for continuous acceptable on hot water, glycol water, chilled water and condenser water.

2.3 FITTINGS

- .1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:

- .1 Cast iron: to ASME B16.1, Class 125.
- .2 Steel: to ASME B16.5.
- .3 Butt-welding fittings: steel, to ASME B16.9.
- .4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.
- .5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M, ductile iron to ASTM A536.

2.4 VALVES

- .1 Connections:
 - .1 NPS2 and smaller: screwed ends.
 - .2 NPS2.1/2 and larger: Flanged or grooved ends.
- .2 Gate valves: to MSS-SP-70 and MSS-SP-80 Application: Isolating equipment, control valves, pipelines:
 - .1 Butterfly valves: to MSS-SP-67 Application: Isolating cells or section of multiple component equipment (eg. multi-section coils, multi-cell cooling towers).
 - .1 NPS 2 1/2 and over: Lug type or Grooved ends.
 - .2 Globe valves: to MSS-SP-80 and 85 Application: Throttling, flow control, emergency bypass.
 - .1 NPS 2 and under:
 - .2 NPS 2 1/2 and over:
 - .1 With composition bronze disc, bronze trim.
- .3 Balancing, for TAB:
 - .1 Sizes: Calibrated balancing valves, as specified this section.
 - .2 NPS 2 and under:
 - .1 copper alloy body threaded and, 2.1 MPa rating, globe style, self sealing measuring ports for temperature or pressure probes, locking tamper proof setting.
 - .2 Mechanical Rooms and Elsewhere: Globe, with plug disc as specified.

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- .3 In lieu of standard malleable iron or copper fittings the Contractor may install the following component system:
 - .1 Union port fitting with air vent and pressure/temperature port.
 - .2 Balancing valve, strainer with drain valve, ball valve combination may also be used.
 - .3 NPS 2 ½ and over:
 - .1 Ductile iron body, flanged or grooved connections, 1700 kPa rating minimum, globe style, self sealing measurement parts for temperature or pressure probes, locking tamper proof setting.
 - .4 Drain valves: Gate, Class 125 non-rising stem, solid wedge disc, as specified.
 - .5 Bypass valves on gate and globe valves NPS 8 and larger: NPS ¾ as specified.
 - .6 Swing check valves: to MSS-SP-71.
 - .1 NPS 2 and under:
 - .1 Class 125 swing, with composition disc, as specified Section.
 - .2 NPS 2 1/2 and over:
 - .1 Flanged or grooved ends: as specified.
 - .7 Silent check valves:
 - .1 NPS 2 and under:
 - .1 As specified.
 - .2 NPS 2 1/2 and over:
 - .1 Flanged or grooved or wafer style ends: as specified.
 - .8 Ball valves:
 - .1 NPS 2 and under: as specified.

3.0 EXECUTION

3.1 PIPING INSTALLATION

- .1 Install pipework in accordance with Section 23 05 15 - Common Installation Requirements for HVAC Pipework by certified journey person and authority having jurisdiction.

3.2 CIRCUIT BALANCING VALVES

- .1 Install flow measuring stations and flow balancing valves as indicated.

3.3 CLEANING, FLUSHING AND START-UP

- .1 In accordance with Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

3.4 TESTING

- .1 Test system in accordance with Section 21 05 01 – Common Work Results - Mechanical. Minimum 1.5 times working pressure or 1000 kPa.
- .2 For glycol systems, retest with ethylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

3.5 BALANCING

- .1 Balance water systems to within plus or minus 5 % of design output.
- .2 Refer to Section 23 05 93 – Testing, Adjusting and Balancing for HVAC, for applicable procedures.

3.6 GLYCOL CHARGING

- .1 Provide mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.

3.7 PERFORMANCE VERIFICATION

- .1 In accordance with Section 23 08 01 – Performance Verification of Mechanical Systems.
- .2 Provide copies of test reports for Commissioning Manuals.

END OF SECTION

1. GENERAL**1.1 Related Work**

- .1 This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Reference Standards

- .1 Provision of specialty components shall be in accordance with ANSI/ASME B31 Codes for Building Services Piping.

1.3 Regulatory Requirements

- .1 Water specialty components shall be provided in compliance with Regulations and Requirements of Province of Ontario Technical Standards & Safety Authority (TSSA).

1.4 System Pressure Ratings

- .1 Piping systems 860 kPa or less operating pressure - 860 kPa rating.
- .2 Piping systems 870 kPa to 1,725 kPa operating pressure – 1,725 kPa rating.

2. PRODUCTS**2.1 Air Vents Automatic – High Capacity Type**

- .1 Non-Serviceable Type:
 - .1 Casing and internal parts suitable for system operating pressure and temperature.
 - .2 Metal construction with outlet threaded to accept vent tubing connection.
 - .3 Automatic float type.
 - .4 Shraeder type venting valve.
 - .5 Acceptable Products:
 - .1 345 kPa maximum operating pressure – Armstrong AW, Dole 75, Maid-O-Mist 6, Taco 426, Watson McDaniel AE 1800.
 - .2 517 kPa maximum operating pressure – Armstrong AW, Dole 75, Maid-O-Mist 6, Taco 426, Watson McDaniel AE 1800.
 - .3 1,034 kPa maximum operating pressure – Armstrong AW, Maid-O-Mist 6, Taco 426, Watson McDaniel AE 1800.

2.2 Air Vents Manual – High Capacity**.1 Globe Type**

- .1 Bronze Body, union bonnet, screwed, 450 Brinell hardened stainless steel trim and plug type disc.

.2 Acceptable Products:

- .1 Class 860 kPa – Crane 14-1/2 LP, Jenkins 2032, Lunkenheimer 73-PS, Toyo 214.
- .2 Class 1,380 kPa – Crane 212P, Jenkins 2050, Lunkenheimer 73-PS, Toyo 214.

2.3 Air Vents Manual – Radiator Type**.1 Needle Type**

- .1 Bronze or steel body, screwed, needle valve.
- .2 Manual key operator.
- .3 860 kPa maximum operating pressure and 120°C maximum operating temperature.
- .4 Acceptable Products: Maid-O-Mist 816.

.2 Hydroscopic Type

- .1 Bronze or steel body, screwed hydroscopic discs.
- .2 Manual screwdriver or key operator.
- .3 Acceptable Products:
 - .1 345 kPa maximum operating pressure – Dunham Bush V19B, Maid-O-Mist 72, Taco 417.
 - .2 517 kPa maximum operating pressure – Maid-O-Mist 72, Taco 417.

2.4 Air Separators

- .1 Provide centrifugal, type with 860 kPa WSP steel tank, galvanized steel 6.0 mm perforated strainer, perforated stainless steel air collector tube and drain connection.

2.5 Air Scoop**2.6 Expansion Tanks – Diaphragm Type**

- .1 Expansion tanks with working pressure to 207 kPa and less than 600 mm in diameter.
 - .1 Steel construction with sealed-in elastomer diaphragm suitable for up to 116°C.
 - .2 Welding performed by certified, qualified welders.
 - .3 Factory tested hydraulically to 517 kPa.
 - .4 Identification plate showing:
 - .1 Manufacturer's name.
 - .2 Expansion tank operating pressure, 207 kPa.
 - .3 Hydraulic test pressure 517 kPa.
 - .4 Date of manufacture.
 - .5 Pre-charge via air charging valve to 83 kPa.
 - .6 Saddles for horizontal installation or base mount for vertical installation.

2.7 Pressure Relief Valves – Water

- .1 Screwed, bronze body or cast-iron body with expanded outlet.
- .2 ASME rated.
- .3 Acceptable Products:
 - .1 Bronze body: Watts 174A, NPS 3/4 to NPS 2.
 - .2 Iron body: Watts 740, NPS 3/4 x 1 to NPS 2 x 2-1/2.

2.8 Pressure Relief Valves - Pump Bypass

- .1 Differential pressure overflow valve to control pump pressure.
- .2 Screwed, bronze body with stainless steel spring.
- .3 Acceptable Products: Braukmann DU 146.

2.9 Strainers

- .1 NPS 2 and under: bronze body, screwed connections.
- .2 NPS 2-1/2 and over: cast-iron body, flanged connections.
- .3 NPS 2 and over: Y or T type strainer with grooved ends with ductile iron body or factory fabricated steel body.
- .4 Suitable for maximum system operating pressure. Where system pressure exceeds 860 kPa, use 1,725 kPa strainer bodies.
- .5 Basket Screen:
 - .1 Bronze, stainless steel or monel perforated screen.
 - .2 35 holes/cm², 1.2 mm diameter perforations, 36% open area.
- .6 Acceptable Products: Armstrong, Muesco, Spirax/Sarco, Toyo, Victaulic Series 730, 732 or W730 for all grooved end strainers.

3. EXECUTION**3.1 Air Vents – Automatic – High Capacity Type**

- .1 Install automatic high capacity air vents at each high point in piping system and where indicated on drawings.
- .2 Install on tees and not on horizontal pipe runs or elbows.
- .3 Install 12 mm minimum isolating gate valve ahead of each air vent, unless air vent has integral shut-off valve.
- .4 Pipe air vent discharge connections (except for glycol) separately to nearest building drain using 6.0 mm hard drawn copper tube. Label ends with permanent labels.

3.2 Air Vents – Manual – High Capacity

- .1 Install manual air vents at high points in piping systems and where indicated on drawings.
- .2 Install on tees and not on horizontal pipe runs or elbows.
- .3 Install isolating gate valve ahead of each vent valve.
- .4 Pipe air vent discharge connections to nearest building drain.

3.3 Air Vents Manual Radiator Type

- .1 Install manual/automatic low capacity air vents on return side of each water heating/cooling terminal element installed above connection to main piping.
- .2 Fit air vent on top of air collecting chamber of NPS 19 mm pipe, 150 mm high.
- .3 Arrange air vents so screwdriver slots or key opening are easily accessible.
- .4 Drill access holes through radiation enclosures, where necessary.

3.4 Air Separator

- .1 Provide on suction side of system circulation pump.

3.5 Combination Balance/Check Valves

- .1 Install combination stop/balance/check valves on discharge of centrifugal pumps as indicated on drawings and/or where scheduled.
- .2 Install in accordance with Manufacturer's recommendations.
- .3 Minimum 5 pipe diameters from pump connections.

3.6 Expansion Tank – Diaphragm Type

- .1 Install expansion/contraction tanks at each location indicated on drawings and as scheduled.
- .2 Install gate valve in system connection.
- .3 Install globe valve in tank drain connection.

3.7 Flexible Pipe Connectors

- .1 Install convoluted and arched pipe connectors, for misalignment connections, where indicated on drawings or required.
- .2 Install in accordance with Manufacturer's recommendations.
- .3 Three Victaulic Style 77 couplings may be used in lieu of flexible connectors for vibration attenuation and stress relieve. The couplings shall be placed in close proximity to the source of the vibration.

3.8 Pressure Reducing Stations – Cold Water

- .1 Install water make-up stations for each hot water, chilled water and other closed water systems where indicated on drawings.
- .2 Pipe relief valve to drain.

3.9 Pressure Relief Valves – Water

- .1 Install pressure relief valve(s) on each heat exchanger to prevent over pressuring.
- .2 Select relief valves to relieve full heat input of heat supply side.
- .3 Pipe relief valve to drain.
- .4 Where one line vents several relief valves, cross sectional area shall equal sum of individual vent areas.

3.10 Pressure Relief Valves – Pump Bypass

- .1 Install pressure relief valves to relieve flow from supply main to return main where indicated on drawings.

3.11 Strainers

- .1 Install pipe line strainers where indicated on drawings.
- .2 Provide isolation valves on either side of strainer to permit cleaning without draining system.
- .3 Blowdown connections:
 - .1 Strainers, NPS 50 mm and under – hot services: nipple and cap.
 - .2 Strainers, NPS 65 mm and over – hot services: nipple, globe valve and nipple.
 - .3 Strainers, all sizes – cold services: plug.

END OF SECTION

1.0 GENERAL

1. MOTORS

- .1 Provide motors for electrically driven equipment specified under Division 15000. Motors shall be high efficiency in accordance to ASHRAE 90.1 requirements.
- .2 Nameplate rating of motor:
 - .1 Not less than input brake horsepower of driven equipment at specified operating condition.
 - .2 Not less than minimum horsepower specified or shown.
- .3 Motors less than 1/2 hp:
 - .1 Continuous duty, resilient mount, single phase, 120 volt, 60 Hz, with speed as indicated.
 - .2 Built-in overload protection.
- .4 1/2 hp Motors:
 - .1 EEMAC, Class B, squirrel cage induction, 1725 rpm, continuous duty, drip proof, ball bearing, 40°C temperature rise, 3 phase, 120/1/60 or 203/230/1/60, 60 Hz type.
 - .2 Sized to come up to rated rpm under load within 12 seconds.
- .5 Motors 1 hp and larger:
 - .1 EEMAC, Class B, squirrel cage induction, 1770 rpm, continuous duty, drip proof, ball bearing, 40°C temperature rise, 3 phase, 575 volt, 60 Hz, with performance equal to or greater than Ontario Hydro Enermark motor Efficiency Level when tested to CSA 390 M 1985, or IEE 112b.
 - .2 Sized to come up to rated rpm under load within 12 seconds.
- .6 Motors larger than 40 HP shall be Y Delta start. Provide starter to suit. Provide motor winding thermistors complete with high temperature cut-outs in all 20 HP and UP motors.

- .7 Provide motors of any size in air ducts, plenum chambers or in air stream inside air conditioning equipment, with Klaxon motor winding thermostats if motor is single phase or three phase up to 20 hp.

2. STARTERS

- .1 Rating: NEMA size
- .2 Starters for single phase motors to be manual type, combination switch with overload relay and pilot lights.
- .3 Starters for three phase motors to be combination magnetic type with HRC fused disconnect and fuses selected in accordance with Article "Motor Protection". Starter for three phase motors to be combination magnetic type with breaker type disconnect selected for symmetrical interrupting rating of 50,000 RMS amperes at 600 volts.
- .4 Starters for three phase motors
 - .1 Three overload elements sized to suit characteristics of motor wired ahead of holding coil.
 - .2 Overload relay with manual reset button, resettable only from inside cover.
 - .3 CSA 22.2 No. 94 Type 3 enclosure, weatherproof, with flange mounted disconnect handles on starter compartment.
 - .4 Auxiliary contacts as required to satisfy interlocking and automatic control requirements.
 - .5 120 volt and 24 volt fused control transformers inside starter enclosure where control wiring extends outside starter enclosure.
 - .6 Cover mounted 120 V "push-to-test" pilot lights as specified on drawing schedules.
 - .7 Additional coil for BAS control as required.
 - .8 Additional features as shown on drawing schedules.
- .5 Provide each starter or disconnect switch with engraved lamicoid nameplate identifying load served.
- .6 Starters for motors equipped with temperature sensing devices in winding to have compatible control unit supplied by motor manufacturer installed in starter enclosure, with 120 volt control transformer, miniature "push-to-test" pilot light to indicate high motor winding temperature, and separately identified push button to reset control unit.
- .7 All starters to be supplied by one manufacturer.

- .8 Where three or more starters are shown grouped together, use wall mounted enclosures.
- .9 Provide wiring diagrams for control circuits in accordance with accepted industry standards.
- .10 Starters to be (excluding OEM equipment):
Standard of Acceptance:
 - Allen-Bradley
 - Cutler-Hammer/Eaton
 - Furnas
 - Square D
 - Klockner-Moeller

3. MOTOR PROTECTION

- .1 Circuit breakers in starters to be sized in accordance with motor starter manufacturer's recommendations.
- .2 Fuses in starters to be CSA certified Form 1, current and energy limiting type 200,000 ampere interrupting capacity with NEMA Class "J" rejection type mountings.
Standard of Acceptance:
 - Chase Shawmutt - Amp. Trap
 - English Electric Company of Canada
 - Appleton Electric Company
- .3 Size fuses installed in starters or in disconnect switches used in conjunction with magnetic starters, for branch circuit and motor protection in accordance with fuse manufacturer's recommendations. Note fan motors are sized for maximum start-up time specified in Article "Motors".
- .4 Provide one spare set of three fuses for each rating and type of fuse used.

4. WIRING FOR MECHANICAL DIVISION 15000

- .1 Division 15000 to supply all electrical motors, starters, controls, relays, thermostats, float switches, pressure switches, flow switches, pilot lights, remote control stations, safety devices, aquastats, control transformers, disconnects for control circuits, and interlocks.
- .2 Division 15000 to mount the above equipment, except for line voltage wall thermostats and starters; these to be mounted by Division 16000.
- .3 Division 16000 to supply and mount isolation switches where required for safe servicing of motors, as well as at electrical panels of all factory assembled package equipment, e.g. rooftop make-up air units, chiller units.

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- .4 Isolation switch to be located within sight of and not more than 10 m from the motor and machinery driven by the motor.
 - .5 Unless otherwise indicated, Division 16000 to provide all power wiring as defined herein.
 - .6 Division 15000 to provide all control and interlock wiring, including connection to equipment and source of supply.
 - .7 Power wiring is defined as all single or three phase wiring carrying the full line current of the mechanical equipment, including all the wiring of line voltage controls and isolation disconnects connected in line between the source and the mechanical equipment and including connection to the equipment.
 - .8 Control and interlock wiring is defined as all mechanical equipment wiring other than power wiring outlined above.
 - .9 Division 15000 to provide detailed wiring diagrams for each motor.
 - .10 Division 15000, unless specifically indicated otherwise, will provide all wiring for damper motor power and control from nearest lighting panel, except where the drawings indicate power outlets by Division 16000. For these instances Division 15000 will wire from the outlet to the damper motor.
 - .11 Wiring methods and standards to conform with those specified in Electrical Division 16000 for area of building in which installation is to be made.
 - .12 Submit shop drawings for control wiring in accordance with Article "Electric Control Wiring Shop Drawings".
 - .13 Electrical materials, equipment and installation procedures under Mechanical Division 15000 to conform to Canadian Electrical Code as amended to date.
 - .14 Conform to requirements of Division 16000 for Division 15000 work under this Section.
 - .15 Wiring: RW-90 X-link type sized to carry 125% of full load running current in accordance with Electrical Code. Minimum no. 12 gauge for power. Colour coded no. 14 gauge for control.
 - .16 Mechanical contractor shall provide 2-pole contactor for 120V/1 ph equipment controlled from BAS. BAS will operate contactor through contactor coil and maintained contact on BAS output.

5. ELECTRICAL CONTROL WIRING SHOP DRAWINGS

- .1 Submit control wiring diagrams for electrical equipment provided under this Division.
- .2 Wiring diagrams
 - .1 In ladder diagram form with 215 mm (8 1/2 in) space between 120 volt energized conductor on left and grounded conductor on right.
 - .2 Individual horizontal lines numbered sequentially starting from 100 and every conductor terminal matching identifying terminal numbers.
 - .3 Show electrical contacts, relays, thermostats, timers and components in control circuits.

6. GROUNDING

- .1 Ground electrical equipment and wiring in accordance with Canadian Electrical Code and Local Authority's Rules and Regulations.
- .2 Ground all motors with separate ground wire back to ground terminal in starter and provide ground lug bolted directly to motor frame inside terminal box of motor.

END OF SECTION

1.1 GENERAL

1.2 SUMMARY

.1 Section includes:

- .1 Materials, components, equipment and chemicals for installation of complete HVAC water treatment.**

1.3 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.**
- .2 Section 01 74 19 – Construction Waste Management and Disposal.**
- .3 Section 01 78 00 – Closeout Submittals.**
- .4 Section 01 91 13 – General Commissioning (Cx) Requirements.**
- .5 Section 23 08 02 – Cleaning and Startup of Mechanical Piping Systems.**

1.4 REFERENCES

- .1 American Society of Mechanical Engineers (ASME).**
 - .1 ASME Boiler and Pressure Vessel Code, Section VII.**
- .2 Health Canada / Workplace Hazardous Materials Information System (WHMIS).**
 - .1 Safety Data Sheets (SDS).**

1.5 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.**
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 – Submittal Procedures.**

.2 Shop Drawings:

- .1 Submit Shop drawings in accordance with Section 01 33 00 – Submittal Procedures.**

1.6 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.
- .2 Trades people to have journeyperson qualifications and training provided by the manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling, and unloading:
 - .1 Deliver, store, and handle in accordance with manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

2.0 PRODUCTS

2.1 MANUFACTURER

- .1 Equipment, chemicals, service by one supplier.

2.2 BYPASS POT FEEDERS

- .1 Bypass filter feeders to be supplied and installed in the following systems:
 - .1 Hot water heating system (space heating).
 - .2 Hot water heating system (domestic hot water).
 - .3 Maximum working pressure: 1378 kPa.
 - .4 Tank shell: 10 gauge steel
 - .5 Tank head: 9 gauge steel.
 - .6 Cap: cast iron with Buna 'N' square O-ring seal. Cap to have wide mouth, easy open-easy close.
 - .7 Vertical style with bottom dished in.

- .8 NPT female $\frac{3}{4}$ connections.
- .9 Provide each bypass feeder with a 30 micron filter bag to filter chemical before injection into closed loop heating systems.
- .10 Capacity: 38 L.

2.3 CLOSED LOOP HOT WATER SYSTEMS CHEMICAL TREATMENT.

- .1 Prior to chemical treatment all closed looped heating piping systems to be mechanically cleaned in accordance with the requirements of Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.
- .2 Chemical treatment to consist of a Molybdate based closed system treatment which shall protect the piping system by forming a thin film on the internal piping surfaces.
- .3 Solution to be added through bypass filter feeder specified previously.
- .4 Provide one (1) Molybdenum test kit to verify water treatment performance.
- .5 Recommended start-up dosage to be in accordance with feedrate as determined by water treatment system supplier. For purpose of tendering consider 75-100ppm of Molybdate.
- .6 Solution to arrive on site in sealed drums in liquid form. Contractor responsible to store the chemical in a cool, dry, well ventilated area.
- .7 Product data:
 - .1 Liquid.
 - .2 Clear pale yellow colour.
 - .3 Zero degree Celcius freeze point.
 - .4 pH of 11.2
 - .5 Specific gravity of 1.132.
- .8 Provide one (1) year supply of chemical to protect systems from corrosion.

2.4 LOW PRESSURE STEAM SYSTEM CHEMICAL TREATMENT

- .1 The low pressure steam chemical treatment system to consist of addition of a multi-blend chemical into the boiler feedwater tank for purpose of scale and corrosion control.

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- .2 Prior to chemical treatment all low pressure steam and condensate return piping to be mechanically cleaned in accordance with the requirements of Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.
 - .3 The addition of chemical to be based upon operation of the boiler feedwater pumps. The 120/1/60 power supply serving the electronic metering pump to be wired to an auxiliary contact from a relay inside the boiler feedwater package control panel such that on a call for boiler feedwater pump operation from the steam boiler low water control the electronic metering pump to commence operation and supply chemical to the boiler feedwater tank. This field wiring to be considered part of this contract.
 - .4 Chemical metering pump:
 - .1 General:
 - .1 Chemical metering pump to be positive displacement, diaphragm type pump. Output volume shall be adjustable while pump is in operation from zero to maximum capacity as indicated.
 - .2 Adjustment to be made by readily accessible dial knobs, one for changing stroke length and the other for changing stroke frequency. Both knobs are to be located opposite the liquid handling end. On-off switch to be integral with frequency control, 'off' position to be below lowest frequency setting.
 - .3 Chemical metering pump to be capable, without a hydraulically backed diaphragm, of injecting chemicals against pressures up to 1722 kPa.
 - .2 Drive:
 - .1 The pump drive totally enclosed with no exposed moving parts. Solid state electronic pulser fully encapsulated with quick connect terminals Electronics housed in chemical resistant enclosure at the

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- .2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.2 CHEMICAL FEED PIPING

- .1 Install crosses at all changes in direction. Install plugs in unused connections.

3.3 WATER TREATMENT SERVICES

- .1 Provide water treatment monitoring and consulting services for period of one year after system start-up. Service to include:
 - .1 Initial water analysis and treatment recommendations, if different from that specified.
 - .2 System start-up assistance.
 - .3 Operating staff training.
 - .4 Provide necessary recording charts and log sheets for one year operation.
 - .5 Provide necessary laboratory and technical assistance.
 - .6 Instructions and advice to operating staff to be clear, concise and in writing.

3.4 START-UP

- .1 Start up water treatment systems in accordance with manufacturer's instructions.

3.5 COMMISSIONING

- .1 Commissioning Agency: to be water treatment supplier.
- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After start-up and before TAB of connected systems.
- .3 Pre-commissioning Inspections:
 - .1 Verify:
 - .1 Presence of test equipment, reagents, chemicals, details of specific tests to be performed, operating instructions.
 - .2 Suitability of log book.
 - .3 Currency and accuracy of raw water analysis.

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- .4 Required quality of treated water.
 - .4 Commissioning procedures - applicable to all Water Treatment Systems:
 - .1 Establish, adjust as necessary and record all automatic controls and chemical feed rates.
 - .2 Monitor performance continuously during commissioning of all connected systems and until acceptance of project.
 - .3 Establish test intervals, regeneration intervals.
 - .4 Record on approved report forms all commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.
 - .5 Establish, monitor and adjust automatic controls and chemical feed rates as necessary.
 - .6 Visit project at specified intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).
 - .7 Advise Region's Representative in writing on all matters regarding installed water treatment systems.
 - .5 Commissioning procedures - closed circuit hydronic systems (water only):
 - .1 Analyze water in system.
 - .2 Based upon an assumed rate of loss approved by Region's Representative, establish rate of chemical feed.
 - .3 Record types, quantities of chemicals applied.
 - .6 Training:
 - .1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.
 - .7 Certificates:
 - .1 Upon completion, furnish certificates confirming satisfactory installation and performance.

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- .8 Commissioning Reports:
- .1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, all other data required by Region's Representative.
- .9 Commissioning activities during Warranty Period:
- .1 Check out water treatment systems on regular basis and submit written report to Region's Representative.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 29.06 – Health and Safety Requirements
- .3 Section 01 74 19 – Construction Waste Management and Disposal.
- .4 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .5 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- .6 Section 23 05 94 – Pressure Testing of Ducted Air Systems.

1.3 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A 480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
 - .3 ASTM A 653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 National Fire Protection Association (NFPA).
 - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

- .3 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual.
 - .3 IAQ Guideline for Occupied Buildings Under Construction, 1st Edition.

1.4 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS SDS - Safety Data for the following:
 - .1 Sealants.
 - .2 Tape.
 - .3 Proprietary Joints.

1.5 QUALITY ASSURANCE

- .1 Certification of Ratings:
 - .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.
 - .2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.
- .3 Installers to be certified to journeyperson level in sheet metal work.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Protect on site stored or installed absorptive material from moisture damage.

.2 Waste Management and Disposal:

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers steel, metal, plastic waste in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Fold up metal and plastic banding, flatten and place in designated area for recycling.

2.0 PRODUCTS**2.1 SEAL CLASSIFICATION****.1 Classification as follows:**

Maximum Pressure Pa	SMACNA Seal Class
> 1000	A
750	B
500	C
250	C
125	C

.2 Seal classification:

- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.
- .3 Class C: transverse joints and connections made air tight with gaskets, sealant tape or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: Centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius or five piece. Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct or 45° entry on branch.
 - .2 Round main and branch: enter main duct at 45° with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
 - .4 Main duct branches: with volume control damper.
- .5 Transitions:
 - .1 Diverging: 20° maximum included angle.
 - .2 Converging: 30° maximum included angle.
- .6 Offsets:
 - .1 Full short radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

2.6 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653, G90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.7 HANGERS AND SUPPORTS

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm.
- .2 Hanger configuration: to SMACNA.
- .3 Hangers: galvanized steel angle with black steel rods to ASHRAE or SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10
2101 to 2400	50x50x5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp steel plate washer.
 - .3 For steel beams: manufactured beam clamps:

3.0 EXECUTION

3.1 GENERAL

- .1 Do work in accordance with NFPA 90A, NFPA 90B, and SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation. Do not place fire stopping material in expansion space between damper sleeve and fire partition.

- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA or as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations. Sealant and tape to be applied to full perimeter of duct.

3.4 LEAKAGE TESTS/COMMISSIONING

- .1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.
- .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Do leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.
- .5 Install no additional ductwork until trial test has been passed.
- .6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90° elbows.
- .7 Complete test before insulation or concealment.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

- .1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.**

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.**
- .2 Section 01 78 00 – Closeout Submittals.**

1.3 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).**
 - .1 Safety Data Sheets (SDS).**
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).**
 - .1 SMACNA – HVAC Duct Construction Standards – Metal and Flexible.**

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.**
- .2 Product Data:**
 - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:**
 - .1 Flexible connections**
 - .2 Duct access doors.**
 - .3 Turning vanes.**
 - .4 Instrument test ports.**
 - .2 Submit WHMIS SDS in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's for adhesive and solvents during application and curing.**
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.**
 - .1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.**

- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's Field Reports: manufacturer's field reports specified.
- .7 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance Ontario Health and Safety standards.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
 - .4 Separate for reuse and recycling and place in designated containers steel, metal, and plastic waste in accordance with Waste Management Plan (WMP).

- .5 Divert unused metal materials from landfill to metal recycling facility as approved by Region's Representative.

2.0 PRODUCTS

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame 0.66 mm thick with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40⁰C to plus 90⁰C, density of 1.3 kg/m².

2.3 ACCESS DOORS IN DUCTS

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Hold open devices.
 - .2 300 x 300 mm glass viewing panels.
 - .3 Up to 300 x 300 mm: two sash locks complete with safety chain.
 - .4 301 to 450 mm: four sash locks complete with safety chain.
 - .5 451 to 1000 mm: piano hinge and minimum two sash locks.
 - .6 Doors over 1000 mm: piano hinge and two handles operable from both sides.
 - .1 Hold open devices.
 - .2 300 X 300 mm glass viewing panels.

2.4 SPIN-IN COLLARS

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Flexible connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: 100 mm.
 - .3 Minimum distance between metal parts when system in operation: 75 mm.
 - .4 Install in accordance with recommendations of SMACNA.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access doors and viewing panels:
 - .1 Size:
 - .1 600 x 600 mm for person size entry.
 - .2 450 x 450 mm for servicing entry.
 - .3 300 x 300 mm for viewing.
 - .4 As indicated.

-
- .2 Locations:
 - .1 Fire and smoke dampers.
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Elsewhere as indicated.
 - .3 Instrument test ports.
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Install insulation port extensions as required.
 - .4 Locations.
 - .1 For traverse readings:
 - .1 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by Region's Representative.
 - .3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

- .1 Have manufacturer's representative of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
- .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
- .4 Obtain reports, within three (3) working days of review, and submit, immediately, to Region's Representative.

3.4 CLEANING

- .1 Perform cleaning operations as specified in Section 01 74 00 – Cleaning and in accordance with Manufacturer's recommendations.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.2 RELATED SECTIONS:

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals.

1.3 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Indicate the following:
 - .1 Specifications.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

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- .2 Instructions: Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

2.0 PRODUCTS

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, 0.8 mm up to 450 mm wide, 1.6 mm maximum up to 1200 mm wide, V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon or bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to

recommendations of SMACNA.

- .3 Maximum blade height: 100 mm.
- .4 Bearings: pin in bronze bushings or self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Maximum leakage: 2 % at 500 Pa.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
- .4 Runouts to registers and diffusers: located as close as possible to main ducts.
- .5 All dampers to be vibration free.
- .6 Ensure damper operators are observable and accessible.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .3 Indicate the following:
 - .1 Performance data.
 - .2 Specifications
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that

materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.5 QUALITY ASSURANCE

.1 Certificates:

.1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

2.0 PRODUCTS

2.1 MULTI-LEAF DAMPERS

.1 Opposed or parallel blade type as indicated.

.2 Structurally formed steel or extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, structurally formed and welded galvanized steel or extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Performance:

.1 Leakage: in closed position to be less than 2% of rated air flow at 500 Pa differential across damper.

- .2 Pressure drop: at full open position to be less than 25 Pa differential across damper at 10 m/s.
- .6 Insulated aluminum dampers:
 - .1 Frames: insulated with extruded polystyrene foam with RSI factor of 5.0.
 - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI factor of 5.0.

2.2 BACK DRAFT DAMPERS

- .1 Automatic gravity operated, multi leaf, aluminum or steel construction with nylon bearings, centre pivoted, spring assisted or counterweighted.

2.3 RELIEF DAMPERS

- .1 Automatic multi-leaf steel or aluminum dampers with ball bearing centre pivoted and counter-weights set to open as indicated.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.
- .5 Ensure dampers are observable and accessible.

3.2 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

.1 Section Includes:

- .1 Fire and smoke dampers, and fire stop flaps.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 23 31 13.01 – Metal Ducts – Low Pressure to 500 Pa.

1.3 REFERENCES

- .1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA).
 - .1 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN4-S112, Fire Test of Fire Damper Assemblies.
 - .2 CAN4-S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
 - .3 ULC-S505, Fusible Links for Fire Protection Service.

1.4 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00- Submittal Procedures.

- .3 Indicate the following:
 - .1 Fire dampers.
 - .2 Smoke dampers.
 - .3 Fire stop flaps.
 - .4 Operators.
 - .5 Fusible links.
 - .6 Design details of break-away joints.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.5 QUALITY ASSURANCE

- .1 Certificates:
 - .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.
 - .2 Provide the following:
 - .1 6 fusible links of each type.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

2.0 PRODUCTS

2.1 FIRE DAMPERS

- .1 Fire dampers: arrangement Type B or C, blades out of air stream listed and bear label of ULC, meet requirements of provincial fire authority and ANSI/NFPA 90A. Fire damper assemblies to be fire tested in accordance with CAN4-S112. Minimum rating 1 ½ hours, dynamically rated.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .3 Top hinged: offset, round or square; multi-blade hinged or interlocking type; roll door type; or guillotine type; sized to maintain full duct cross section.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 Retaining angle iron frame, 40 x 40 x 3.0 mm, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed to prevent disruption of ductwork or impair damper operation.
- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.

- .10 Unless otherwise indicated, the installation details given in SMACNA Fire, Smoke, and Radiation Damper Installation Guide for HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 SMOKE DAMPERS

- .1 To be ULC or UL listed and labelled.
- .2 Normally closed reverse action smoke vent (S/D-RASV): folding blade type, opening by gravity upon detection of smoke, and/or from remote alarm signalling device actuated by an electro thermal link. Two flexible stainless steel blade edge seals to provide required constant sealing pressure.
- .3 Normally open smoke/seal (S/D-SSSD): folding blade type, closing when actuated by means of electro thermal link and/or from remote alarm signalling device. Blade edge seals of flexible stainless steel shall provide required constant sealing pressure. Stainless steel negator springs with locking devices shall ensure positive closure for units mounted horizontally in vertical ducts.
- .4 Motorized (S/D-M): folding blade type, normally open with power on. When power is interrupted damper shall close automatically. Both damper and damper operator shall be ULC listed and labelled.
- .5 Electro thermal link (S/D-ETL): dual responsive fusible link which melts when subjected to local heat of 74° C and from external electrical impulse of low power and short duration; ULC or UL listed and labelled.

2.3 COMBINATION FIRE AND SMOKE DAMPERS

- .1 Damper: similar in all respects to smoke dampers specified above.
- .2 Combined actuator: electrical control system actuated from smoke sensor or smoke detection system and from fusible link.

2.4 FIRE STOP FLAPS

- .1 To be ULC listed and labelled and fire tested in accordance with CAN4-S112.2.
- .2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps to be held open with fusible link conforming to ULC-S505 and close at 74°

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or

specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00 – Air Duct Accessories.
- .5 Coordinate with installer of firestopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 COMMISSIONING

- .1 Commission in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for acoustic duct lining.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C 423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - .2 ASTM C 916, Standard Specification for Adhesives for Duct Thermal Insulation.
 - .3 ASTM C 1071, Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
 - .4 ASTM C 1338, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
 - .5 ASTM G 21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- .5 Thermal Insulation Association of Canada (TIAC).
 - .1 National Insulation Standards.
- .6 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA).

- .1 SMACNA, HVAC, Duct Construction Standards, Metal and Flexible.
- .2 SMACNA IAQ Guideline for Occupied Buildings Under Construction.
- .7 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .8 Underwriter's Laboratories of Canada (ULC).
 - .1 CAN/ULC-S102, Methods of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials.
- .2 Protect on site stored or installed absorptive material from moisture damage.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .5 Ensure emptied containers are sealed and stored safely.
- .6 Fold up metal banding, flatten and place in designated area for recycling.

2.0 PRODUCTS

2.1 DUCT LINER

-
- .1 General:
 - .1 Mineral Fibre duct liner: air surface coated mat facing.
 - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102, NFPA 90A and NFPA 90B.
 - .3 Fungi resistance: to ASTM C 1338, ASTM G 21.
 - .2 Rigid:
 - .1 Use on flat surfaces where indicated
 - .2 25 mm thick, to ASTM C 1071, Type 2, fibrous glass rigid board duct liner.
 - .3 Density: 48 kg/m³ minimum.
 - .4 Thermal resistance to be minimum 0.76 (m². degrees C)/W for 25 mm thickness, 1.15 (m².degrees C)/W for 38 mm thickness, 1.53 (m².degrees C)/W for 50 mm thickness when tested in accordance with ASTM C 177, at 24 degrees C mean temperature.
 - .5 Maximum velocity on faced air side: 20.3 m/sec.
 - .6 Minimum NRC of 0.70 at 25 mm thickness based on Type A mounting to ASTM C 423.
 - .3 Flexible:
 - .1 Use on round or oval surfaces.
 - .2 25 mm thick, to ASTM C 1071 Type 1, fibrous glass blanket duct liner.
 - .3 Density: 24 kg/m³ minimum.
 - .4 Thermal resistance to be minimum 0.37 (m².degrees C)/W for 12 mm thickness, 0.74 (m².degrees C)/W for 25 mm thickness, 1.11 (m².degrees C)/W for 38 mm thickness, 1.41 (m².degrees C)/W to 50 mm thickness when tested in accordance with ASTM C 177, at 24 degrees C mean temperature.
 - .5 Maximum velocity on coated air side: 25.4 m/sec.
 - .6 Minimum NRC of 0.65 at 25 mm thickness based on Type A mounting to ASTM C 423.

2.2 ADHESIVE

- .1 Adhesive: to NFPA 90A and NFPA 90B, ASTM C916.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.
- .3 Water-based fire retardant type.

2.3 FASTENERS

- .1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.

2.4 JOINT TAPE

- .1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

2.5 SEALER

- .1 Meet requirements of NFPA 90A and NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

3.0 EXECUTION

3.1 GENERAL

- .1 Do work in accordance with SMACNA HVAC DCS, TIAC, and as indicated except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.

3.2 DUCT LINER

- .1 Install in accordance with manufacturer's recommendations, and as follows:
 - .1 Fasten to interior sheet metal surface with 100 % coverage of adhesive to ASTM C 916
 - .1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.
 - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres impact driven mechanical fasteners to compress duct liner sufficiently to hold it firmly in place.

- .1 Spacing of mechanical fasteners in accordance with SMACNA HVAC DCS, TIAC.
- .2 In systems, where air velocities exceed 20.3 m/sec, install galvanized sheet metal nosing to leading edges of duct liner.

3.3 JOINTS

- .1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
 - .1 Bed tape in sealer.
 - .2 Apply two coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Region's Representative.
- .3 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

END OF SECTION

1. GENERAL

1.1 Provide duct accessories as required.

1.2 Shop drawings

- .1 Submit shop drawings in form of manufacturer's catalogue literature for:
 - .1 flexible connections, sealants and tapes, duct access doors, and instrument test ports.
 - .2 Sd f
 - .3 Sdf s

2. PRODUCTS

2.1 Flexible connections

- .1 Rectangular ductwork - indoors:
 - .1 0.7 mm (0.027 in) thick, 0.98 kg/m² (29 oz/yd²) neoprene coated fibreglass weave.
 - .2 0.66 mm (24 ga) galvanized sheet metal frame, with fabric clamped with double locked offset seams.
 - .3 Temperature range -37°C to 112°C (-35°F to 235°F).
 - .4 Meets ULC-S109.
 - .5 UL listed fabric.

Standard of Acceptance:

- DynAir Neoprene NT
- Duro-Dyne Metal-Fab Neoprene
- Elgen – Neoprene

- .2 Round ductwork - indoors:
 - .1 0.7 mm (0.027 in) thick, 0.98 kg/m² (29 oz/yd²) neoprene coated fibreglass weave, spine reinforced duct connector.
 - .2 0.66 mm (24 ga) galvanized sheet metal frame, with fabric clenched with double locked offset seams and channel spine with locking band, channel clamped onto locking band during factory manufacture.
 - .3 Temperature range -37°C to 112°C (-35°F to 235°F).
 - .4 Meets ULC-S109.
 - .5 UL listed fabric.

Standard of Acceptance:

- DynAir Circu-flex

- .6 For ductwork operating at fan inlet pressure of 875 Pa (3.5 inWG) negative, or greater:
- .7 Connector tensioned and supported by compression spring actuated fitting:
 - 3 springs for ductwork up to 300 mm (12 in) diameter.
 - 5 springs for ductwork over 300 mm (12 in) up to 600 mm (24 in) diameter.
 - 7 springs for ductwork over 900 mm (24 in) up to 900 mm (36 in) diameter.

- 9 springs for ductwork over 900 mm diameter.
Standard of Acceptance:
 - DynAir Circu-flex with 'Spring-Link'
- .3 Rectangular ductwork - outdoors:
 - .1 0.5 mm (0.02 in) thick, 0.81 kg/m² (24 oz/yd²) hypalon coated fibreglass weave.
 - .2 0.66 mm (24 ga) galvanized sheet metal frame, with fabric clamped with double locked offset seams.
 - .3 Sunlight resistant.
 - .4 Temperature range -50°C to 126°C (-46°F to 260°F).
 - .5 Meets ULC-S109.
 - .6 UL listed fabric.
Standard of Acceptance:
 - DynAir Hypalon
 - Duro-Dyne Hypalon
 - Elgen – Hypalon
- .4 Round ductwork - outdoors:
 - .1 0.5 mm (0.02 in) thick, 0.81 kg/m² (24 oz/yd²) hypalon coated fibreglass weave, spine reinforced duct connector.
 - .2 0.66 mm (24 ga) galvanized sheet metal frame, with fabric clamped with double locked offset seams and channel spine with locking band, channel clamped onto locking band during factory manufacture.
 - .3 Sunlight resistant.
 - .4 Temperature range -50°C to 126°C (-46°F to 260°F).
 - .5 Meets ULC-S109.
 - .6 UL listed fabric.
Standard of Acceptance:
 - DynAir Circu-flex
- .7 For ductwork operating at fan inlet pressure of 875 Pa (3.5 inWG) negative, or greater:
- .8 Connector tensioned and supported by compression spring assembly:
 - 3 springs for ductwork up to 300 mm (12 in) diameter.
 - 5 springs for ductwork over 300 mm (12 in) up to 600 mm (24 in) diameter.
 - 7 springs for ductwork over 900 mm (24 in) up to 900 mm (36 in) diameter.
 - 9 springs for ductwork over 900 mm diameter.
Standard of Acceptance:
 - DynAir Circu-flex with 'Spring-Link'

2.2 Sealant and tape

- .1 Sealant:
 - .1 Water based polymer, non-flammable, high velocity duct sealing compound.
 - .2 Meets requirements of NFPA 90A and 90B.
 - .3 Oil resistant.
 - .4 UL Class 1 listed.

- .5 Operating temperature range of -7°C to 93°C (20°F to 200°F).

Standard of Acceptance:

- Dyn-O-Seal II: -40EC to 93EC (-40EF to 200EF).
- Foster 32-17, 32-19
- Hardcast Iron Grip IG-601: -18EC to 93EC (0EF to 200EF).
- Childers CP-145 CHIL-FLEX, CP-146 CHIL-SEAM
- BVI Ductbond
- Ductmate PRO-Seal/FIBER-Seal

- .2 Tape:

- .1 PVC treated, non-flammable, open weave (gauze) fibreglass tape, 50 mm (2 in) wide.
- .2 UL listed.
- .3 50 mm (2 in) wide.

Standard of Acceptance:

- Duro-Dyne FT-2
- Hardcast
- Ideal
- 3M

2.3 Access doors

- .1 For rectangular duct and round duct to 1550 mm (62 in) diameter in all ductwork:
- .1 Formed G60 galvanized steel to suit duct diameter.
- .2 Integral sponge neoprene or rubber gasket installed on inner cover.
- .3 Minimum of two locking grips with stop nut.

Standard of Acceptance:

- Nexus PDQ access door
- Ductmate METU and "Sandwich"
- Nailor Series 08xx-1

- .2 Shop fabricated plenum and casing access doors:

- .1 In uninsulated plenum, construct plenum access door from same material as plenum, one sheet metal thickness heavier, minimum 0.6 mm (26 ga) thick with gasketed sheet metal angle frame.
- .2 In insulated plenum, construct duct access door as double wall insulated sandwich of same material as plenum, one sheet metal thickness heavier, minimum 0.6 mm (26 ga) thick with gasketed sheet metal angle frame and 25 mm (1 in) thick rigid glassfibre insulation.
- .3 Weld door frames in place.
- .4 Gasket material: neoprene or sponge rubber.
- .5 Hardware:
- .1 two sash locks for doors up to 300 mm x 300 mm (12 in x 12 in).
- .2 four sash locks from doors over 301 mm x 301 mm (12 in x 12 in) to 301 mm x 600 mm (12 in x 24 in).

Standard of Acceptance:

- DynAir DSL-1 for sash locks

- .3 piano hinge and minimum 2 handles operable from both sides for doors over 301 mm x 601 mm (12 in x 25 in) to 301 mm x 900 mm (12 in x 36 in).

Standard of Acceptance:

- DynAir ADH-50 for operable handles

- .4 Piano hinge or minimum three butt hinges, and minimum 2 handles operable from both sides for doors over 301 mm x 901 mm (12 in x 36 in).

Standard of Acceptance:

- DynAir ADH-100 for operable handles

2.4 Instrument test ports:

- .1 Zamac alloy body installed over neoprene gasket.
- .2 Temperature range 0EC to 72EC (32EF to 165EF).
- .3 High density polyethylene expansion plug fitted with neoprene O-ring.
- .4 Length to suit insulation thickness.
- .5 22 mm (3/4 in) instrument opening.

Standard of Acceptance:

- DynAir PTP-1

2.5 Splitter damper ball joint and bracket

- .1 Zinc alloy body casting.
- .2 Nylon cup washer for swivel ball.
- .3 Neoprene back-up gasket.
- .4 Locking by steel set screw with hardened steel point
- .5 1.6 mm (16 ga) damper bracket with brass pivot and stainless steel spring.
- .6 Compression ring/locknut assembly for control and clamping.
- .7 Self-aligning slider.
- .8 DynAir BJ-14 with SB-14

2.6 Spin-in collars

- .1 To be of prime galvanized steel, minimum 22 ga.
- .2 With butterfly damper and locknut.

Standard of Acceptance:

- Flexmaster Spin-in collar up to 125 mm (5 in) diameter
- Flexmaster Series 1806 Deluxe 150 mm (6 in) diameter and over

3. EXECUTION

3.1 Flexible connections

- .1 Provide flexible connections between air handling equipment and ductwork as shown.
- .2 Corner join or seam to be sewn and NOT STAPLED.
- .3 Length of connection: 75 mm (3 in) for movement up 40 mm (1.5 in).
150 mm (6 in) for movement over 40 mm (1.5 in).
- .4 Minimum distance between metal parts when system is in operation: 25 mm (1 in).
- .5 Securely anchor ductwork to building structure on building side of flexible connection.

3.2 Access doors

- .1 Access doors in ducts to be maximum size possible with 1:1.5 aspect ratio in duct sizes up to and including 350 mm (14 in). With duct sizes 380 mm (15 in) and larger, access doors to be 300 mm x 380 mm (12 in x 15 in).
- .2 Access doors in casings and plenum to be 1500 mm (60 in) high by minimum 450 mm (18 in) wide, OR motor width plus 50 mm (2 in) or larger, where required for removal of motors or other equipment.
- .3 Install access doors in ductwork before and after:
 - .1 reheat coils
 - .2 air monitoring devices and at:
 - .3 fire dampers
 - .4 duct smoke detectors
- .4 control elements

3.3 Instrument test ports

- .1 Install instrument test ports:
 - .1 For duct velocity traverse readings
 - .2 For temperature readings
 - .3 Across duct or plenum at not more than 250 mm (10 in) intervals for traverses and at not more than 500 mm (20 in) for temperature measurements.
- .2 Traverse locations:
 - .1 At ducted inlets to roof and wall exhausters.
 - .2 At inlets and outlets of other fan systems.
 - .3 At main and sub-main, where sub main serves more than one outlet.
- .3 Temperature measurement locations:
 - .1 At outside air intakes.
 - .2 At mixed air locations.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.

3.4 Spin-in collars

- .1 Install spin-ins in ductwork with velocities of 6.1 m/s (1200 ft/min) or less.

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Section 233360

Duct Accessories

- .2 Secure with sheetmetal screws.
- .3 Seal spin-in with duct sealing compound.

END OF SECTION

1. **GENERAL**

1.1 Related Work

- .1 This Specification Section forms part of Contract Documents and is to be read, interpreted and coordinated with other parts.

1.2 Quality Assurance

- 1. Catalogued or published ratings shall be those obtained from tests carried out by Manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

2. **PRODUCTS**

2.1 Air Terminals

.1 General:

- .1 Grilles, registers and diffusers shall be product of one Manufacturer.
- .2 Refer to drawings for sizes and air quantities.
- .3 Refer to schedules on drawings for details.
- .4 Base air outlet application on space noise level of NC 30 maximum.
- .5 Air terminals shall be checked for compatibility with ceiling types. Refer to Architectural reflected ceiling plans.
- .6 Manufacturer (other than design listed) shall match performance data and indicate specific comparison for each item, with shop drawing submission.
- .7 Ceiling mounted air terminals shall be provided with means for attachment of two seismic security wires at opposite corners on each air terminal.
- .8 Provide concealed baffles, where necessary, to direct air away from walls, columns or other obstructions within radius of air terminal operation.
- .9 Provide auxiliary frames for diffusers located in drywall ceilings and grilles mounted in gypsum walls in public areas. In other areas grilles should be attached to ductwork, or flanged to outside of the opening.

- .10 Standard of Acceptance for general grilles, registers, and diffusers: EH Price, Nailor, Titus, Kruger, Tuttle & Bailey

2.2 Louvres - Stationary

.1 General:

- .1 Extruded aluminum frames and blades.
- .2 Welded construction with exposed joints ground flush and smooth or mechanically fastened with stainless steel fasteners.
- .3 Lower assembly sealed and watertight.
- .4 Removable 1.29 mm diameter aluminum wire bird screen with 12 mm mesh. Bird screen mounted in 0.81 mm thick aluminum folded frame. Frame to be installed inside louvre.
- .5 Mill finish.

2.3 Hoods - Gooseneck

- .1 Galvanized steel construction.
- .2 Thickness and fabrication to ASHRAE & SMACNA standards.
- .3 12 mm aluminum wire bird screen mounted in removable U-frame.
- .4 Mount unit on minimum 300 mm high curb base.

3. **EXECUTION**

3.1 Louvres

- .1 Provide necessary flashing and counterflashing for louvres installed in walls.
- .2 Caulk louvre and flashing and counterflashing to make installation water tight.
- .3 Blank-off panels shall be constructed to SMACNA standards, minimum 1.00 mm sandwich panel with 25 mm thick fibreglass insulation.
- .4 Blank-off panels shall have painted flat black enamel finish

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.

1.3 REFERENCES

- .1 American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE).
 - .1 ASHRAE 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.

1.4 SYSTEM DESCRIPTION

- .1 Performance requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.5 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate following:
 - .1 Capacity

- .2 Throw and terminal velocity
- .3 Noise criteria
- .4 Pressure drop
- .5 Neck velocity
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste Management and Disposal.

2.0 PRODUCTS

2.1 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.

.3 Concealed manual volume control damper operators as indicated.

.4 Colour: standard or as directed by Region's Representative.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

.1 See Schedule.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 See Schedule.

2.5 DIFFUSERS

.1 See Schedule.

2.6 LINEAR GRILLES

.1 See Schedule.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 Install with flat head stainless steel or cadmium plated screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.

.4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms and elsewhere.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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Section 233713
Diffuser, Registers
and Grilles

- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

- .1 Air Movement and Control Association (AMCA)
 - .1 AMCA 540, Test Method for Louvres Impacted by Wind Borne Debris.
 - .2 AMCA 550, Test Method for High Velocity Wind Driven Rain Resistant Louvres.
- .2 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)
 - .1 ANSI/NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E 90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .6 Society of Automotive Engineers (SAE)

1.4 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.5 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.
 - .4 Dimensions
 - .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .3 Test Reports:
 - .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90.

1.6 DELIVERY, STORAGE, AND HANDLING

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

2.0 PRODUCTS

2.1 GRAVITY ROOF OUTSIDE AIR INTAKES AND RELIEF VENTS

- .1 Factory manufactured aluminum hinged at curb line.
 - .1 Complete with integral birdscreen of 2.7 mm diam 12 mm mesh aluminum wire.
 - .2 Vertical or horizontal backdraft dampers on four faces.
 - .3 Maximum throat velocity: 3.3 m/s intake.
 - .4 Maximum loss through unit: 15 Pa exhaust static pressure.
 - .5 Maximum velocity through damper area: 1.5 m/s.
 - .6 Shape: as indicated.

2.2 FIXED LOUVRES - ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: drainable, stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
- .4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit. Flanged frame or flush frame as indicated.
- .5 Mullions: at 1500 mm maximum centres.
- .6 Fastenings: stainless steel with nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 12 mm on exhaust and intake mesh, 2.0 mm diameter wire aluminum or galvanized birdscreen on inside face of louvres in formed U-frame.
- .8 Finish: factory applied enamel, or anodized as indicated. Colour: to Region Representative's approval.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking around to ensure weather tightness.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 01 78 00 – Closeout Submittals.
- .4 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.2 REFERENCES

- .1 Canadian Standards Association, (CSA International)
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 Underwriter's Laboratories of Canada (ULC)

1.3 SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate following: dimensions, capacities, hanging methods, installation procedures.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 CERTIFICATION OF RATINGS

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Region's Representative.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

- .3 Dispose of corrugated cardboard, polystyrene, plastic, packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.7 TRAINING

- .1 Provide training in accordance with Section 01 79 00.13 – Demonstration and Training for Building Commissioning.

2.0 PRODUCTS

2.1 BOX STYLE HOOD WITHOUT MAKEUP AIR

- .1 Ventilator construction of stainless steel with UL/ULC listed filters. Ventilator provided with stainless steel all welded exhaust duct collar with a 25 mm connection flange. All joints and seams welded and/or liquid tight. All exposed welds ground and polished to the original finish of metal.
- .2 Hanging brackets supplied on each unit for ceiling or wall mount installations.
- .3 Ventilators equipped with UL/ULC listed self-closing, spring loaded fire damper assembly activated by listed fusible link, rated at (141° C).
- .4 UL/ULC listed air balancing damper provided for balancing of single and multiple ventilator systems. All dampers accessible through ventilator plenum.
- .5 Ventilators listed by Underwriters Laboratories and/or Underwriters Laboratories of Canada and meet all NFPA 96 requirements.
- .6 HOOD SIZE – LENGTH____, WIDTH____, HEIGHT____: information on drawings.
- .7 SERVICES – EXHAUST AIR: information on drawings.
- .8 STATIC PRESSURE: information on drawings.
- .9 COLLAR SIZE: information on drawings.
- .10 ELECTRICAL: 120/1/60, WATT: information on drawings.
- .11 DIRECT CONNECT TO JUNCTION BOX(ES) : FOR LIGHTS, information on drawings.
- .12 Flush mounted fluorescent light fixture(s) 914 mm or 1219 mm long (2 x 40 watts) include lamps.
- .13 Fire detection Wet Chemical Fire Extinguishing Systems.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install hoods in accordance with manufacturer's instructions.
- .2 Install filter/filter media prior to acceptance.
- .3 Operation sequences for washdown hood:
 - .1 Turn selector switch to run
 - .1 Exhaust fan energized
 - .2 Turn selector switch to wash
 - .1 Exhaust fan de-energized
 - .2 Wash begins after 60 seconds delay
 - .3 Wash ends after preset time (3 min.)
 - .3 Fire condition wet chemical discharge
 - .1 Upon system discharge with fans operating
 - .1 Exhaust fan continues to run
 - .2 Supply fan shuts down
 - .3 Hot water wash does not come on
 - .4 Dry contacts of fire relay close.
 - .2 Upon system discharge with fans not operating
 - .1 Exhaust fan automatically starts
 - .2 Hot water wash remains off or stops
 - .3 Dry contacts of a fire relay reclose.

3.2 COMMISSIONING

- .1 Test system and layout in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

T-734-26

Building Systems Upgrade – HVAC, LED and Nursing Call, 2387 Industrial St, Burlington

Section 235100

Breeching,
Chimneys and Stacks**1.0 GENERAL****1.1 SUMMARY**

- .1 Section includes:
 - .1 Materials, accessories, and installation for breeching, chimneys, and stacks.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.

1.3 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .2 Underwriters' Laboratories of Canada (ULC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS)

1.4 SUBMITTALS

- .1 Product Data
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate following:
 - .1 Methods of sealing sections.
 - .2 Methods of expansion.

T-734-26

Building Systems Upgrade – HVAC, LED and Nursing Call, 2387 Industrial St, Burlington

Section 235100

Breeching,
Chimneys and Stacks

-
- .3 Details of thimbles.
 - .4 Bases/Foundations.
 - .5 Supports.
 - .6 Guy details.
 - .7 Rain caps.
 - .8 Installation procedures.
 - .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .4 Closeout Submittals
 - .1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with Canadian Environmental Protection Act (CEPA), Canadian Environmental Assessment Act (CEAA), Transportation of Dangerous Goods Act (TDGA), and applicable Provincial regulations.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Ontario Health and Safety standards.
 - .1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

2.0 PRODUCTS

2.1 BREECHING

- .1 Shop fabricated 3.5 mm thick mild steel, or stainless welded, with sweep bends from boiler outlet to thimble or chimney as indicated per 2.2 below.

2.2 FUELS: PRESSURE CHIMNEY AND BREECHING

- .1 ULC labelled, 760°C rated, all fuels.
- .2 Sectional, prefabricated, double wall with air space and mineral wool insulation with mated fittings and couplings.
 - .1 Liner: 0.9 mm thick, type 304 stainless steel up to 900 mm diameter, 1.2 mm up to 1200 mm.
 - .2 Shell: 0.6 mm thick, type 304 stainless steel up to 600 mm diameter, 0.9 mm up to 1200 mm.
 - .3 Outer seals between sections: to suit application.
 - .4 Inner seals between sections: to suit application.
 - .5 Guy section and guy tensions where indicated.
 - .6 Storm collar and flashing for non-combustible roofs.
 - .7 Ventilated roof thimble and roof support assembly for combustible roofs.
 - .8 Stack cap.
 - .9 Lateral tee 45°, drain tee cap.

2.3 STEEL CHIMNEY REFRACTORY LINED (OVER 1200 MM DIAMETER)

- .1 Material:
 - .1 Prefabricated sections with 90 mm thick high temperature impervious insulating refractory lining, centrifugally spun into 3.5 mm thick circular casing.
- .2 Construction:
 - .1 Prefabricated sections, welded on site or at factory. Use high temperature insulating cement at joints in refractory lining.

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- .3 Welding:
 - .1 To full thickness. All welds ground smooth.
 - .4 Supports:
 - .1 Welded gussets, cleats and bolts for installation on concrete base.
 - .2 Chimney to be self supporting or laterally and vertically braced.
 - .5 Breeching entry:
 - .1 Tee section with 150 mm minimum refractory lined projection.
 - .6 Access door, in bottom section.
 - .7 Drain connection, at base of stack.
 - .8 Dimensions, as indicated.

2.4 ACCESSORIES

- .1 Cleanouts: bolted, gasketed type, full size of breeching, as indicated.
- .2 Barometric dampers: single or double acting, 70% of full size of breeching area, as recommended by manufacturer.
- .3 Hangers and supports: in accordance with recommendations of Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA).
- .4 Rain cap.
- .5 Expansion sleeves with heat resistant caulking, held in place as indicated.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION - GENERAL

- .1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .2 Suspend breeching at 1.5 m centres and at each joint.

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- .3 Support chimneys at bottom, roof and intermediate levels as indicated.
 - .4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.
 - .5 Install flashings on chimneys penetrating roofs, as indicated.
 - .6 Install rain caps and cleanouts, as indicated.

3.3 INSTALLATION - REFRACTORY LINED STEEL CHIMNEY

- .1 Grind all welds smooth to form appearance of single tube.
- .2 Seal insulating refractory at top of stack.
- .3 Pack annular space around breeching at entry tee with heat resistant caulking.
- .4 Run drain line from drain connection to nearest floor drain or ground.
- .5 On completion, paint one coat of rust inhibitive primer and two coats of heat resisting paint of colour, make and quality as approved by Region's Representative.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.2 REFERENCES

- .1 Air Movement and Control Association (AMCA).
 - .1 AMCA 210. Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .2 Natural Electrical Manufacturers Association (NEMA).
 - .1 NEMA MG-1 Motors and Generators
- .3 Canadian Standards Association (CSA).

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS – Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. WHMIS acceptable to Labour Canada, and Health Canada.
- .3 Submit product data sheets for unit heaters. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Mounting methods.
 - .4 Physical size.
 - .5 kW rating, voltage, phase.
 - .6 Cabinet material thicknesses.
 - .7 Limitations.
 - .8 Colour and finish.

- .4 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Equipment, capacity and piping connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2.0 PRODUCTS

2.1 CABINET UNIT HEATERS

- .1 Cabinet type: surface semi-recessed or recessed as indicated, 1.6 mm thick steel with rounded exposed corners and edges, removable panels, glass fibre insulation and integral air outlet and inlet.
- .2 Finish with factory applied primer coat.
- .3 Special cabinets or front panels: as indicated.
- .4 Coils: aluminum fins mechanically bonded to copper tubes as indicated. Hydrostatically tested to 1 MPa.
- .5 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.
- .6 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.
- .7 Filters: removable 25 mm thick fibrous glass throwaway or permanent washable type.
- .8 Capacity: as indicated.

- .9 Control:
 - .1 3 speed on-off switch with integral overloads in cabinet or wall mounted as indicated.
 - .2 Low limit aquastat strapped on to steam or hot water heating supply set to prevent fan operating below 27 °C.

2.2 HORIZONTAL UNIT HEATERS

- .1 Casing: 1.6 mm thick cold rolled steel, gloss enamel finish, with threaded connections for hanger rods.
- .2 Coils: seamless copper tubing, silver brazed to steel headers with evenly spaced aluminum fins mechanically bonded to tubing. Hydrostatically test to 1 MPa.
- .3 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard.
- .4 Motor: speed as indicated continuous duty, built-in overload protection, and resilient motor supports.
- .5 Air outlet: two-way adjustable louvres.
- .6 Capacity as indicated, base steam capacity on 14 kPa, base hot water heating capacity on 8 °C E.W.T. and 11° C temperature drop, 15° C - E.A.T.
- .7 Control:
 - .1 3 speed on-off switch with integral overloads in cabinet or wall mounted as indicated.
 - .2 Low limit aquastat strapped on to steam or hot water heating supply set to prevent fan operating below 27 °C.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Provide double swing pipe joints as indicated.
- .3 Check final location with Region's Representative if different from that indicated prior to installation.
 - .1 Should deviations beyond allowable clearances arise, request and follow Region Representative's directive.

- .4 Hot water units: for each unit, install gate or ball valve on inlet as indicated and calibrated balancing valve on outlet of each unit. Install drain valve at low point.
 - .1 Install manual or automatic air vent at high point as indicated.
- .5 Clean finned tubes and comb straight.
- .6 Provide supplementary suspension steel as required.
- .7 Install thermostats in locations indicated.
- .8 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.2 COMMISSIONING

- .1 Commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1, Division 23.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
 - .2 CAN/CSA-22.3 No. 1, Overhead Systems.
 - .3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

1.3 CARE, OPERATION AND START-UP

- .1 Instruct Region's Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 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.
- .4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.
- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Quality Control:
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, load balance report as described in sentence 3.4.6.
 - .4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Region's Representative.
- .6 Manufacturer's Field Reports: submit to Region's Representative within seven (7) working days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in paragraph 3.6- FIELD QUALITY CONTROL.

.7 Single Line Electrical Diagrams

- .1 Provide single line electrical diagrams in glazed frames as follows:
 - .1 Electrical distribution system: locate in main electrical room.
 - .2 Electrical power generation and distribution systems: locate in power plant rooms.
- .2 Provide fire alarm riser diagram, plan and zoning of building in glazed frame at fire alarm control panel and annunciator.
- .3 Drawings: 600 x 600 mm minimum size.

.8 The electrical contractor shall supply an arc-flash study of the building's entire distribution system, to be performed by the successful electrical equipment supplier. The Contractor shall furnish the supplier with distances, wire lengths and transformer shop drawings as required. Supply also stick-on labels for all equipment, identifying the arc-flash hazard rating of each distribution board and panel board. Such labelling shall meet CSA Z462. Supply one full set of Personal Protective Equipment required for each identified hazard rating in the arc-flash study. The arc-flash study shall be submitted with the electrical distribution equipment shop drawings. The electrical distribution equipment shop drawings will not be reviewed until the arc-flash study is received. Refer to Section 26 05 73 – Power Systems Studies for further details.

.9 Shop Drawings:

- .1 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or materials.
- .2 Where applicable, indicate wiring, single line and schematic diagrams.
- .3 Include wiring drawings or diagrams showing interconnection with work of other sections.
- .4 Each shop drawing will be stamped and signed by the Contractor before submitting, stating that he has checked the drawings against the requirements as called for in the Contract Documents and also in the case where the equipment is attached to or connects to other equipment, that it has been properly coordinated with this equipment, whether supplied under Division 26 or under other Divisions.
- .5 Each shop drawing for non-catalogue items shall be prepared specifically for this project. If brochures are submitted for catalogue items, the brochures shall be marked deficiently indicating the item or items to be supplied.

- .6 Work shall not be proceeded with on any of the equipment until final review of shop drawings received by the Contractor.
- .7 Shop drawing review is for general compliance with Contract Documents. No responsibility is assumed by the Region's Representative for correctness of dimensions or details. Corrections or comments, or lack thereof, made on the shop drawings during the Region Representative's review does not relieve the Contractor from compliance with the requirements of the drawings and specifications.
- .8 If changes are required, notify Region's Representative of these changes before they are made.
- .10 Operation and Maintenance Data:
 - .1 Provide operation and maintenance data for incorporation into operation and maintenance manuals. Manuals shall be supplied to Section 01 78 00 – Closeout Submittals.
 - .2 Include in operations and maintenance data:
 - .1 Details of design elements, construction features, component function and maintenance requirements to permit effective start-up operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Technical data, product data, supplemented by bulletins, exploded views, technical description of items and part lists. Advertising or sales literature not acceptable.
 - .3 Wiring and schematic diagrams and performance curves.
 - .4 Names and addresses of local suppliers for items included in maintenance manuals.
 - .5 Copy of reviewed shop drawings.
- .11 As-Built Drawings: Submit in accordance with 01 78 00 – Closeout Submittals.

1.6 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Region's Representative will provide drawings and specifications required by Electrical Inspection Division and Supply Authority at no cost.

- .4 Notify Region's Representative of changes required by Electrical Inspection Division prior to making changes.
- .5 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Region's Representative.

1.7 CO-ORDINATION

- .1 Co-ordinate work with work of other divisions to avoid conflict.
- .2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.
- .3 Locate all existing underground services and make all parties aware of their existence and location.
- .4 Where interference occurs, Region's Representative must approve relocation of equipment and materials regardless of installation order.
- .5 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Region's Representative shall decide the extent of relocation required.

1.8 CUTTING AND PATCHING

- .1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.

1.9 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.10 RECORD DRAWINGS

- .1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.
- .2 Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.
- .3 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.
- .4 Submit record drawings within 30 days prior to start of commissioning.

1.11 INSPECTION OF WORK

- .1 The Region's Representative will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.12 SCHEDULING OF WORK

- .1 Work shall be scheduled in phases as per other divisions of the architectural specifications.
- .2 Become familiar with the phasing requirements for the work and comply with these conditions.
- .3 No additional monies will be paid for Contractor's requirement to comply with work phasing conditions.

1.13 FIRE RATING OF PENETRATIONS

- .1 Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.
- .2 Use 3M brand or equal fire barrier products at each penetration.
- .3 Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.
- .4 Acceptable manufacturers: Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project.

1.14 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Region's Representative with schedule within 2 weeks after award of Contract.

1.15 SYSTEM START-UP

- .1 Instruct Region's Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .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 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.

1.16 WASTE MANAGEMENT & DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal: paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring and metal materials from landfill to metal recycling facility as approved by Region's Representative.
- .5 Place materials defined as hazardous or toxic waste in designated containers.
- .6 Ensure emptied containers are sealed and stored safely for disposal.
- .7 Unused materials must not be disposed of into sewer system, streams, lakes, onto ground or in other locations, where it will pose health or environmental hazard.
- .8 Do not dispose of preservative treated wood through incineration. Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Region's Representative.
- .9 Divert unused batteries and antifreeze to appropriate recycling facilities as approved by Region's Representative.

1.17 ANCHOR BOLTS AND TEMPLATES

- .1 Supply anchor bolts and templates for installation by other divisions.

1.18 ACCESS DOORS

- .1 Supply access doors for concealed electrical equipment to allow operation, inspection, adjusting and servicing.
- .2 Use flush mounted 600 x 600 mm for body entry and 300 x 300 mm for hand entry unless otherwise noted. Doors to open 180, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .3 Material:
 - .1 Use stainless steel with brushed satin or polished finish in special areas such as tiled or marble surfaces and as directed by Region's Representative.
 - .2 In remaining areas, use prime coated steel.
 - .3 Use ULC rated access doors in fire rated walls and ceilings.
- .4 Installation
 - .1 Locate so that concealed items are accessible.
 - .2 Locate so that hand or body entry (as applicable) is achieved.
 - .3 Installation is specified in applicable sections.

2.0 PRODUCTS

2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Supplier and installer responsibility is indicated on electrical drawings and related mechanical responsibility is indicated on mechanical drawings, where applicable.
- .2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25 and shown on mechanical drawings. Division 25 – EMCS Controls Contractor is responsible for all conduit, wiring and connections below 50V which are related to control systems in Division 25 and shall comply with the requirements of Division 26 for standard of quality.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Division.
- .3 Factory assemble control panels and component assemblies.

2.3 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

2.4 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Region's Representative.
- .2 Porcelain enamel decal signs, minimum size 175 x 250 mm.
- .3 Install adhesive backed polyester arc flash hazard labels on all major electrical components including the service entrance switchboard, bus duct breakers, panelboards, disconnects, splitters and master control centers/starters. Refer to Section 26 05 73 – Power System Studies for further details.

2.5 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters

NAMEPLATE SIZES

Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

- .3 Wording on nameplates and labels to be approved by Region's Representative prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate and label.
- .5 Identification to be English (and French where applicable).
- .6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system name and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages and transformer number.
- .10 Panelboards: indicate name, voltage, capacity and upstream panel serving mains.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1, Canadian Electrical Code.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

<u>Conduit System</u>	<u>Prime Color</u>	<u>Auxiliary Color</u>
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.9 MATERIAL SPECIFIED

- .1 Where additional manufacturers are named under Articles entitled "Approved Manufacturers", the selection of a named manufacturer, in reference to a particular article, shall be the Contractor's responsibility.
- .2 Materials or products specified without the clauses "or approved equal" or "approved manufacturers" shall be supplied as specified and no proposed substitution will be considered.

- .3 Where approvals are granted for the use of other equipment, any and all changes or additions required for the installation or operation of the approved equipment will be made by the Contractor at their own expense and no claims will be approved for any such changes, notwithstanding approval of shop drawings. Equipment that is accepted and installed and then does not perform as represented by original submitted data shall be replaced by the Contractor with equipment as specified at no charge to the Region's Representative.
- .4 Trade names are given as a standard of quality and configuration.

2.10 EXAMINATION OF OTHER WORK

- .1 This Division requires the examination of the material and work for all other Divisions under which the work of this Section depends for proper completion. Any defect in work, levels or materials shall be reported to the Region's Representative. The work of this Division shall not commence until such defects have been corrected. This also applied to existing work installed under other Contracts.

2.11 CUTTING, PATCHING, SLEEVES AND PLATES

- .1 All drilling for hangers, rod, inserts and work of similar nature shall be done by Division 26.
- .2 Have core drilled openings installed in foundation walls to accommodate the work of this Division. Seal conduit or cable through the cored opening using industrial duty round compression seals sized to suit diameter of conduit or cable. Cable seals to be Roxtec RS type or approved equal.

2.12 HANGERS AND EQUIPMENT SUPPORTS

- .1 All equipment provided under the Electrical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation and to avoid strain on conduit, etc. Auxiliary supports where required shall be provided under this Division.
- .2 Hammer driven hanger supports, eg. staples, nails, etc. will not be used.
- .3 Expansion bolts, inserted after concrete has been poured are acceptable.
- .4 Paint all hangers, eg. U-bolts, trapeze hangers, etc. BEFORE INSTALLATION.
- .5 Wire is not an acceptable conduit support.

2.13 TESTING, ACCEPTANCE AND GUARANTEE

- .1 The work of this Contract shall be tested and installed and any defects in operation shall be remedied immediately. Tests required by local authorities shall

be the responsibility of the Contractor. When the work is completed, it shall be tested in its entirety and shall be in good working order before the Region Representative's Certificate of Acceptance shall be issued.

- .2 A written guarantee shall be supplied to the Region's Representative by the Contractor covering the prompt making good of any and all defects in material and workmanship for the period of one (1) year from the date of acceptance and the making good of any such defects shall be completely the responsibility of the Contractor.

3.0 EXECUTION

3.1 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.2 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 27 26 – Wiring Devices.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.4 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

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- .3 Install electrical at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 Above top of continuous baseboard heater: 200mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300 mm.
 - .5 Wall mounted telephone and interphone outlets: 1400 mm.
 - .6 Fire alarm stations: 1200 mm.
 - .7 Fire alarm bells: 2400 mm.
 - .8 Television outlets: 300 mm.
 - .9 Wall mounted speakers: 2400 mm.
 - .10 Clocks: 2400 mm.
 - .11 Door bell pushbuttons: 1200 mm.
 - .12 Exit lights: 2400 mm.
 - .13 Emergency lighting heads: 2400 mm.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted

shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

- .2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.
- .3 Perform tests in Accordance with this section as noted and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .4 Load Balance:
 - .1 Measure phase current to panelboard with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.
- .5 Contractor to conduct and pay for the costs the following tests:
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operations of systems where applicable.
 - .5 Systems: fire alarm system, communications.
- .6 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .7 Insulation resistance testing.
 - .1 Measure and record circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Measure and record 350 – 600 V circuits, feeders and equipment with a 1000 V instrument.

- .3 Check resistance to ground before energizing and record value.
- .8 Carry out tests in presence of Region's Representative.
- .9 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.
- .10 Submit test results for Region Representative's review and include in Commissioning Manuals specified in Section 01 91 13 – General Commissioning (Cx) Requirements.

3.7 PREPERATION FOR FIRESTOPPING

- .1 Prepare the space between conduits and adjacent sleeve or fire separation for the use of fire proofing material.
- .2 Where cables or conduits pass through fire rated walls or ceilings, sleeve with steel conduit and prepare the opening for fire and smoke sealing and seal with proper fire and smoke rated material.
- .3 Where conduits pass through fire or smoke rated partitions, install a junction box in the conduit just prior to exiting the space. Use this junction box to install smoke stopping material.

3.8 PAINTING

- .1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes that have been damaged too extensively to be primed and touched up.

3.9 TRIAL USAGE

- .1 Region's Representative may use equipment and systems for test purposes prior to acceptance.
Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Lighting system.
 - .2 Power distribution system.
 - .3 Communication systems.
 - .4 Metering system.

- .5 Public address system.

3.10 TESTS

- .1 Give 24 h written notice of date for tests. Conceal work only after testing and approval by Consultant. Conduct tests in presence of Consultant. Bear costs including re-testing and making good.
- .2 Equipment: test as specified in relevant sections.
- .3 Prior to tests, isolate all equipment or other parts that are not designed to withstand test pressures or test medium.

3.11 DRAWINGS, CHANGES, ACCESSIBILITY

- .1 The drawings shall be considered to show the general character and scope of work and not the exact details of the installation.
- .2 The installation shall be complete with all supports and accessories required for a complete operative and satisfactory installation.
- .3 The location, arrangement and connection of equipment and materials as shown on the drawings represent a close approximation to the intent and requirements of the Contract.
- .4 The right is reserved by the Region's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work. Such changes shall be done at no extra cost to the Region's Representative unless the location, arrangement or connection is more than 3.0 m from that shown.
- .5 Actual location of existing services shall be verified in the field where necessary before work is commenced.
- .6 Changes and modifications necessary to ensure co-ordination and to avoid interference or conflicts with other trades, or to accommodate existing conditions, shall be made at no extra cost to the Region's Representative.

3.12 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .3 Complete final cleaning of equipment and work area as acceptable to Region's Representative.

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-
- .4 At time of final cleaning, clean lighting, reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

END OF SECTION

1.0 GENERAL

1.1 SUMMARY

- .1 This Section includes requirements for selective demolition and removal of electrical safety and security, communications components including removal of conduit, junction boxes, and panels to source (home run removal) and incidentals required to complete work described in this Section.

1.2 REFERENCES

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

1.3 DEFINITIONS

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

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.
- .2 Scheduling:
 - .1 Account for Region Representative's continued occupancy requirements and schedule staged occupancy and worksite activities Region's Representative.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: Perform work of this Section in accordance with:
 - .1 Provincial/Territorial Workers' Compensation Boards/Commissions.
 - .2 Provincial/Territorial Occupational Health and Safety Standards and Programs.

1.7 SITE CONDITIONS

- .1 Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.
- .2 Discovery of Hazardous Substances:
 - .1 It is not expected that Hazardous Substances will be encountered in the Work. Immediately notify Region's Representative if materials suspected of containing hazardous substances are encountered.
- .3 Hazardous Substances:
 - .1 Hazardous Substances are present in building to be selectively demolished. A report on the presence of Hazardous Substances is attached as an information document to this Specification for review and use. Examine report to become aware of locations where hazardous materials are present. Coordinate removal of hazardous materials as per appropriate sections of this specification.

1.8 SALVAGE AND DEBRIS MATERIALS

- .1 Demolished items become Contractor's property and will be removed from Project site; except for items indicated as being reused, salvaged, or otherwise indicated to remain the Region Representative's property.

- .2 Carefully remove materials and items designated for salvage and store in a manner to prevent damage or devaluation of.
 - .1 Leave main electrical distribution panel in place; panel can be used for temporary construction power for this and subsequent contracts, coordinate temporary power connections with Region's Representative.
 - .2 Leave main telephone terminal backboard in place; panel can be used for temporary construction telephone system for this and subsequent contracts; coordinate temporary telephone connections with Region's Representative.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Selective Interior Demolition for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.
- .2 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.
- .3 Fire stopping Repair Materials: Use fire stopping materials compatible with existing fire stopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

3.0 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:

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

3.3 EXECUTION

- .1 Coordinate requirements of this Section with information as follows:
 - .1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.
 - .2 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
 - .3 Disconnect and remove existing fire alarm system including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
 - .4 Disconnect and remove communication systems including associated conduits, boxes, cabling, and similar items unless specifically noted otherwise.
 - .5 Disconnect and remove telephone outlets, associated conduit, cabling and sub terminal backboards and related accessories; maintain telephone service and main terminal backboard as is.
 - .6 Perform demolition work in a neat and workmanlike manner:

-
- .1 Remove tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
 - .7 Disconnect panel feeders back to main distribution panel and re label respective circuit breaker as “SPARE”.
 - .8 Place weatherproof blank cover plates on exterior outlet boxes remaining after demolition and removal activities.
 - .9 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices and equipment.
 - .10 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
 - .11 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.4 CLOSEOUT ACTIVITIES

- .1 Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .4 Section 26 05 00 – Common Work Results - Electrical.
- .5 Section 26 05 22 - Connectors and Terminations.
- .6 Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No. 131, Type TECK90 Cable.
 - .2 CAN/CSA-C61089, Round Wire Concentric Lay Overhead Electrical Stranded Conductors.
- .2 National Electrical Manufacturers' Association (NEMA)/Insulated Cable Engineers Association (ICEA)
 - .1 ICEA S-93-639/NEMA WC74, 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.

1.3 SUBMITTALS

- .1 Provided manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 DELIVERY, STORAGE AND HANDLING

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

2.0 PRODUCTS**2.1 PRIMARY OVERHEAD CONDUCTORS 1001 - 5000 V**

- .1 Copper, 5kV polyethylene insulation, size as indicated.
- .2 Bare aluminum conductors steel reinforced: to CAN/CSA-C49.1, size as indicated.

2.2 RUBBER INSULATED CABLES 1001 - 5000 V

- .1 Conductors: copper size as indicated.
- .2 Insulation: cross-linked polyethylene compound rated RWU90.
- .3 Insulation shielding: semi-conducting non-metallic tape over insulation and served wire shield over tape.
- .4 Cable jacket: thermosetting with separator tape between shield and jacket.

2.3 ALUMINUM SHEATHED CABLES 1001 - 5000 V

- .1 Conductors: copper size as indicated.
- .1 Insulation: cross-linked polyethylene Type RA90 rated 5kV.
- .2 Sheath: seamless, corrugated, aluminum.
- .3 Outer covering: extruded PVC.

2.4 CONCENTRIC NEUTRAL POWER CABLE 1001 - 5000 V

- .1 Single copper conductor, size as indicated.
- .1 Semi-conducting strand shield.
- .2 Insulation: cross-linked polyethylene rated 90°C and 5kV.
- .3 Semi-conducting insulation shielding layer.
- .4 Copper neutral wires applied helically over insulation shield equivalent to 100% full capacity.
- .5 Separator mylar tape over neutral wires.
- .6 Extruded PVC jacket rated minus 40°C.

2.5 PRIMARY OVERHEAD CONDUCTORS 5001 - 15000 V

- .1 Bare, copper conductors, size as indicated.
- .2 Bare aluminum conductors steel reinforced: to CAN/CSA-C49.1, size as indicated.

2.6 RUBBER INSULATED CABLES 5001 - 15000 V

- .1 Single copper conductor, size as indicated.
- .2 Strand shielding.
- .3 Insulation: of chemically cross-linked thermosetting polyethylene material rated 90°C and 15 kV to NEMA WC7-1992/ICEAS-66-524.
- .4 Insulation shielding of semi-conducting non-metallic tape over insulation, and served wire shield over tape.
- .5 Barrier tape over shield.
- .6 Overall jacket of PVC rated minus 40°C.

2.7 CONCENTRIC NEUTRAL POWER CABLES 5001 - 15000 V

- .1 Concentric neutral power cable: to NEMA WC7 ICEAS-66-524.
- .2 Single copper conductor, size as indicated.
- .3 Semi-conducting extruded shield.
- .4 Class 2 compact round.
- .5 Insulation: cross-linked thermosetting polyethylene material rated 90°C and 15kV for 100 % voltage level.
- .6 Semi-conducting insulation shielding layer.
- .7 Copper neutral wires applied helically over insulation shield equivalent to 100 % full capacity.
- .8 Separator tape over neutral wires.
- .9 Extruded PVC jacket rated minus 40°C.

2.8 TECK POWER CABLE 1001 - 15000 V

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Bare copper grounding conductor, size as indicated.
- .3 Copper circuit conductors, size and number as indicated.
- .4 Strand shielding
- .5 Insulation: chemically cross-linked thermosetting polyethylene rated RW90 15 kV to ICEA S-93-639/NEMA WC74.
- .6 Insulation shielding: semi-conducting non-metallic tape over insulation and served wire shield over tape to ICEA S-93-639/NEMA WC74.
- .7 Separator tape over conductor assembly.
- .8 Inner jacket of PVC.
- .9 Interlocked steel armour.
- .10 Overall PVC jacket rated ☐

3.0 EXECUTION**3.1 INSTALLATION**

- .1 Install primary conductors on pole lines.
- .2 Install primary cables in ducts and manholes in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.
- .3 Install primary cables in trenches in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.
- .4 Provide supports and accessories for installation of high voltage power cable.
- .5 Install stress cones, terminations and splices in accordance with manufacturer's instructions.
- .6 Install grounding in accordance with local inspection authority having jurisdiction.
- .7 Provide cable identification tags and identify each phase conductor of power cable.

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3.2 FIELD QUANTITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Use of qualified tradespersons for installation, splicing, termination and testing of high voltage power cables.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

2.0 PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for copper bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper bar.
 - .5 Sized for conductors and bars as indicated.

- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .2 Refer to drawings for wiring type required under different applications.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
 - .2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

2.0 PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper and ACM alloy conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE and RWU90 XLPE as indicated.
 - .1 Use RW90 XLPE or RWU90 XLPE in underground conduits.
 - .2 For direct buried underground cables, use RWU90 XLPE.
 - .3 RWU90 XLPE not required under interior floor slabs.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V, typically used for insulated ground wires.
- .4 Type ACM conductors permitted for feeders above 60 amps.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper and ACM alloy, size as indicated.

- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE, rating – 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum, compliant to applicable Building Code classification for this project.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 1500 mm centers.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight and/or type approved for TECK cable, as indicated.

2.3 MINERAL-INSULATED CABLES

- .1 Conductors: solid bare soft-annealed copper, size as indicated.
- .2 Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.
- .3 Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250°C.
- .4 Overall jacket: PVC applied over the sheath and compliant to applicable Building Code classification for this project for direct buried and wet locations, as indicated.
- .5 Two hour fire rating.
- .6 Connectors: watertight, field installed, approved for MI cable.
- .7 Termination kits: field installed approved for MI cable.

2.4 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.

- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: standard as required, complete with anti-short rings.

2.5 CONTROL CABLES

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket. Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -40° C polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jacket.

2.6 NON-METALLIC SHEATHED CABLE

- .1 Non-metallic sheathed copper cable type: NMD90 nylon, size as indicated.

2.7 ACM CONDUCTORS

- .1 Annealed, compacted aluminum alloy conductor material (ACM) for circuits 60 amps or more, single or multi-conductor, 600 volt insulation.
- .2 Type: AC90, ACWU90 and TECK90.
- .3 Armour: interlocked aluminum strip.
- .4 Conductivity: 61% IACS to that of copper.
- .5 Outer jacket: ACWU90 PVC jacket, FT-4 rated suitable for direct buried and Div. 1 and Div. 2 hazardous locations.

3.0 EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Region's Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 No splices permitted in panel board feeders in new construction. Splices in re-work or renovation projects only with pre-approval by Region's Representative.

3.2 GENERAL CABLE INSTALLATION

- .1 Lay cable in cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .3 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings. In cable troughs in accordance with Section 26 05 33.01- Surface and Lighting Fixture Raceways.
 - .2 Overhead service conductors in accordance with Section 26 24 01 - Service Equipment.

3.4 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Install cable concealed, securely supported by straps and hangers.

3.5 INSTALLATION OF MINERAL-INSULATED CABLES

- .1 Run cable exposed, securely supported by straps.
- .2 Support 2 h fire rated cables at 1m intervals.

-
- .3 Make cable terminations by using factory-made kits.
 - .4 At cable terminations use thermoplastic sleeving over bare conductors.
 - .5 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.
 - .6 Do not splice cables.

3.6 INSTALLATION OF ARMOURED CABLES (AC-90)

- .1 Group cables wherever possible.
- .2 Use permitted only for work in movable partitions and vertical power supply drops to lighting fixtures.
- .3 Ensure all cables are terminated and made safe prior to ceiling grid being installed. All lighting drops to be terminated safely, with approved connectors, within an approved box, complete with cover.

3.7 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit as indicated.
- .2 Ground control cable shield.

3.8 INSTALLATION OF NON-METALLIC SHEATHED CABLE

- .1 Install cables.
- .2 Install straps and box connectors to cables as required.
- .3 Use permitted in wood stud construction only.

3.9 INSTALLATION OF ACM CONDUCTORS

- .1 Install ACM cables as per the latest edition of the Canadian Electrical Code and manufacturers installation requirements.
- .2 Do not terminate ACM conductors with a copper bodied connector.
- .3 Apply oxide coating on base cables as per electrical code requirements.

END OF SECTION

1.0 GENERAL

1.1 INSTALLATION TOOLS

- .1 Include with the material one complete set of installation tools. Tools to include all hydraulic pumps, fittings, compression dyes, cutting tools, measuring devices necessary to install all components.
- .2 Include AC-90 cable cutting tool (side cutters or back saws not permitted).

2.0 PRODUCTS

2.1 15KV TERMINATION KIT FOR 1/0MCM 15KV CABLE

- .1 Hydrophobic silicon body.
- .2 High-K stress control.
- .3 BIL rating 110 kV.
- .4 Compatible with size 1/0 AWG stranded copper 15 kV cable.
- .5 The exact kit selection will be based on the actual 1/0 AWG cable dimensions.

2.2 15KV CONNECTOR LUGS

- .1 Suitable for use with a 1/0 AWG cable.
- .2 The exact lug selection will be based on the actual 1/0 AWG cable dimensions.

2.3 TOOLS

- .1 One Thomas and Betts TBM5 installing tool.
- .2 For 3M terminations - two 3M CPK-A tool kits.
- .3 AC-90 cutting tool.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No. 41.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE).
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.0.4, Bonding and Grounding of Electrical Equipment (Protective Grounding).

1.3 SUBMITTALS

- .1 Provided manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 DELIVERY, STORAGE AND HANDLING

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

2.0 PRODUCTS

2.1 MATERIALS

- .1 Rod electrodes: copper clad steel, 19 mm dia by 3 m long.
- .2 Plate electrode: copper surface area 2 m², 2 mm thick.
- .3 Conductors: bare, stranded, un tinned soft annealed copper wire, size No 4/0 AWG and 2/0 AWG for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.

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- .4 Conductors: pvc insulated coloured green, stranded un tinned soft annealed copper wire, size No. 4 AWG for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers.
 - .5 Conductors: pvc insulated coloured green, stranded un tinned soft annealed copper wire No. 10 AWG for grounding meter and relay cases.
 - .6 Conductors: No. 3/0 AWG extra flexible (425 strands) copper conductor for connection of switch mechanism operating rod to gradient control mat, fence gates, vault doors.
 - .7 Bolted removable test links.
 - .8 Gradient control mat: copper, size 1.5 x 1.5 m, 50 x 50 mm mesh and 2 mm thick.
 - .9 Accessories: non-corroding, necessary for complete grounding system, type, size material as indicated, including:
 - .1 Grounding and bonding bushings,
 - .2 Protective type clamps,
 - .3 Bolted type conductor connectors,
 - .4 Thermit welded type conductor connectors,
 - .5 Bonding jumpers, straps,
 - .6 Pressure wire connectors.
 - .10 Grounding resistance bank: in door, 3 phase, star connected liquid type, rating as indicated.
 - .11 Zig-zag grounding transformer: in door, 3 phase, star connected, air cooled, iron core, KVA size and voltage as indicated.
 - .12 Cable sheath isolating transformer or sleeves.
 - .13 Wire connectors and terminations: as indicated.

3.0 EXECUTION

3.1 GROUNDING INSTALLATION

- .1 Install continuous grounding system including, electrodes, conductors, connectors and accessories in accordance with CSA C22.2 No.0.4 and requirements of local authority having jurisdiction.

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- .2 Ground fences to grounding system independent of station ground.
 - .3 Install connectors in accordance with manufacturer's instructions.
 - .4 Protect exposed grounding conductors from mechanical injury.
 - .5 Make buried connections, and connections to electrodes, structural steel work, using copper welding by thermit process.
 - .6 Use mechanical connectors for grounding connections to equipment provided with lugs.
 - .7 Use No. 4/0 AWG bare copper cable for main ground bus of substation and No. 2/0 AWG mhd bare copper cable for taps on risers from main ground bus to equipment.
 - .8 Use tinned copper conductors for aluminum structures.
 - .9 Do not use bare copper conductors near un-jacketed lead sheath cables.
 - .10 Install grounding resistor bank, as indicated.
 - .11 Install zig-zag grounding transformer, as indicated.

3.2 ELECTRODE INSTALLATION

- .1 Install ground rod or plate electrodes, as indicated. Make grounding connections to station equipment.
- .2 Install ground rod electrodes at transformer and switchgear locations.
- .3 Install gradient control mats. Connect mats to station ground electrode and switch mechanism operating rods.
- .4 Make special provision for installing electrodes that will give acceptable resistance to ground value, where rock or sand terrain prevails.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections as indicated to typical station equipment including: metallic water main, line sky wire, neutral, gradient control mats. Non current carrying parts of: transformers, generators, motors, circuit breakers, reclosers, current transformers, frames of gang-operated switches and fuse cutout bases. Cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers. Meter and relay cases. Any exposed building metal, within or forming part of station enclosure. Sub-station fences, pothead bodies. Outdoor lighting.
- .2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.

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- .3 Connect metallic piping (water, oil, air, etc.) inside station to main ground bus at several locations, including each service location within station. Make connections to metallic water pipes outside station to assist in reduction of station ground resistance value.

3.4 NEUTRAL GROUNDING

- .1 Connect transformer neutral and distribution neutral together using 600 V insulated conductor to one side of ground test link, the other side of the test link being connected directly to main station ground. Ensure distribution neutral and neutrals of potential transformers and service banks are bonded directly to transformer neutral and not to main station ground.
- .2 Interconnect electrodes and neutrals at each grounding installation.
- .3 Connect neutral of station service transformer to main neutral bus with tap of same size as secondary neutral.
- .4 Ground transformer tank with continuous conductor from tank ground lug through connector on ground bus to primary neutral. Connect neutral bushing at transformer to primary neutral in same manner.

3.5 POLE MOUNTED SWITCHING DEVICE GROUNDING

- .1 Drive four ground rods 3 m long at base of each pole on which group-operated line switching devices are mounted.
- .2 Arrange rods in square formation with 3 m sides, located so that operator must stand within square to operate switch
- .3 Interconnect ground rods with No. 2/0 AWG stranded annealed copper conductor and join to switch operating handle ground wires.
- .4 Connect operating handle of switch to handle base with No. 3/0 AWG extra flexible copper conductor.

3.6 POLE MOUNTED TRANSFORMER GROUNDING

- .1 Drive ground rods at base of each pole on which transformers are mounted and interconnect transformer, system neutral, lightning arresters and ground rods.

3.7 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

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- .2 Perform earth loop test and resistance tests using method appropriate to site conditions and to approval of Region's Representative and local authority having jurisdiction.
 - .3 Perform test before energizing electrical system.
 - .4 Engage testing agent to inspect grounding and perform resistance test before backfill.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA)
 - .1 CAN/CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities, where applicable.

2.0 PRODUCTS

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6.0 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.
- .3 Rod electrodes: copper clad steel 19 mm dia by 3.0 m long.
- .4 Plate electrodes: copper, surface area 0.2 m², 1.6 mm thick.
- .5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .6 Insulated grounding conductors: green, type TW.
- .7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.

- .3 Bolted type conductor connectors, as required by local authority having jurisdiction.
- .4 Thermit welded type conductor connectors, as indicated.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

3.0 EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run insulated copper ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.
- .13 Ground secondary service pedestals.

3.2 MANHOLES

- .1 Install conveniently located grounding electrode and size 3/0 stranded copper conductor in each manhole.
- .2 Install ground rod in each manhole so that top projects through bottom of manhole. Provide with lug to which grounding connection can be made.

3.3 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod, plate electrodes and make grounding connections.
- .5 Bond separate, multiple electrodes together.
- .6 Use size 2/0, 3/0 or 4/0 AWG copper conductors for connections to electrodes as required by code.
- .7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.4 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.5 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.6 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

- .2 Sound, fire alarm, intercommunication systems as indicated.

3.7 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 19 13 – General Commissioning (Cx) Requirements.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Region's Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION

1.0 GENERAL (NOT APPLICABLE)**2.0 PRODUCTS****2.1 SUPPORT CHANNELS**

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings as required.

3.0 EXECUTION**3.1 INSTALLATION**

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
 - .4 Strap AC-90 cable at box location plus every 900 mm.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

- .8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing, wood blocking, plastic strap or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Region's Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results – Electrical.

1.2 SUBMITTALS

- .1 Submit shop drawings and product data for cabinets.
- .2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.

2.0 PRODUCTS

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm fir plywood backboard for surface flush mounting.

3.0 EXECUTION

3.1 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .5 Ensure all electrical boxes above drywall ceilings are accessible via a properly sized access door installed directly below the box in drywall ceilings. Temporary removal of electrical light fixtures are not considered safe access to above ceiling electrical boxes and shall not be permitted.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results – Electrical.
- .2 Section 26 05 29 – Hangers and Supports for Electrical Systems.
- .3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.

2.0 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables. For use in wood stud construction only.

2.5 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.
- .5 Double split rings for AC-90 terminations.

2.6 SERVICE FITTINGS

- .1 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation.
- .2 Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate two amphenol jack connectors.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

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Section 260532
Outlet Boxes,
Conduit Boxes and
Fittings

-
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
 - .6 Identify systems for outlet boxes as required.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No. 62, Surface Raceway Systems.

1.3 SUBMITTALS

- .1 Indicate types of raceways with terminology similar to that used in this Section.
- .2 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

2.0 PRODUCTS

2.1 SURFACE RACEWAY SYSTEM (WIRING PULLED IN)

- .1 Steel: to CSA C22.2 No. 62, one piece, free of sharp edges.
- .2 Corners, pull boxes, elbows, tees, two piece assembly to facilitate site wiring.
- .3 Finish: buff enamel.
- .4 Necessary switch, receptacle, extension boxes, adapters and utility fittings required for complete installation.

2.2 SURFACE RACEWAY SYSTEM (WIRING LAID IN)

- .1 Steel: to CSA C22.2 No. 62, two piece.
 - .1 Finish: buff enamel.
- .2 Necessary switch, receptacle, extension boxes, adapters and utility fittings required for complete installation.

2.3 SURFACE FLOOR RACEWAY SYSTEM

- .1 Steel: to CSA C22.2 No. 62, two piece, manufactured as lay-in type raceway.
- .2 Finish: buff enamel.

2.4 CHANNEL RACEWAY

- .1 Channel type raceway: to CSA C22.2 No. 62, steel, perforated.

2.5 PLASTIC RACEWAY

- .1 Plastic raceway: to CSA C22.2 No. 62, rigid extruded polyvinyl chloride with slots on either side of raceway for exit of wiring.
- .2 Channel: with solid snap-on cover throughout entire length.

2.6 LIGHTING FIXTURE RACEWAY

- .1 Fluorescent fixture support system using channel type raceway with snap-on cover.
- .2 Channel: minimum 1.6 mm thick.
- .3 Clamp hangers with threaded rod.

2.7 FITTINGS

- .1 Elbows, tees, couplings and hanger fittings: to CSA C22.2 No. 62, manufactured as accessories to raceway supplied.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install raceways before installation of wiring. Install covers for raceways and fittings after installation or wiring.
- .2 Install supports, elbows, tees, connectors, fittings, bushings, adaptors as required.
- .3 Keep number of elbows, offsets, connections to minimum.
- .4 Use wiring with mechanical protection in channel raceways.
- .5 Install barriers in raceways where different voltage systems are indicated.

END OF SECTION

1.0 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware, a National Standard of Canada.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.

1.2 SUBMITTALS

- .1 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .2 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

2.0 PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.
- .6 FRE conduit: to CSA C22.2.
- .7 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3,

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90°, 45 ° or 22.5 ° bends are required for 25 mm and larger conduits.
- .3 Ensure conduit bends other than factory “ells” are made with an approved bender. Making offsets and other bends by cutting and rejoining 90 degree bends are not permitted.
- .4 Connectors and couplings for EMT. Steel set-screw type, size as required.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change or violate any part of the installed system components or the CSA/UL certification of these components.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .4 Surface mount conduits except in finished areas or as indicated.
- .5 Use rigid hot dipped galvanized steel threaded conduit for exposed work below 2.4 m above finished floor.
- .6 Use epoxy coated conduit underground in corrosive areas and where exposed to exterior elements. (ie: pole mounted service entrance conduits)
- .7 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury, as well as concealed work in masonry construction.
- .8 Use rigid PVC conduit underground and buried in or under concrete slab on grade.
- .9 Use FRE conduit for encasement in concrete duct bank for service entrance feeders.
- .10 Use flexible metal conduit for connection to motors in dry areas connection to recessed incandescent fixtures without a prewired outlet box connection to surface or recessed fluorescent fixtures work in movable metal partitions.
- .11 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .12 Use AC-90 for vertical power supply drops to light fixtures.
- .13 Use explosion proof flexible connection for connection to explosion proof motors.

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- .14 Install conduit sealing fittings in hazardous areas. Fill with compound.
 - .15 Minimum conduit size for lighting and power circuits: 19 mm. 12 mm conduit is acceptable for switch leg drops only where one two-wire circuit and ground is required.
 - .16 Install EMT conduit from computer room branch circuit panel to outlet boxes located in sub floor.
 - .17 Install EMT conduit from computer room branch circuit panel to junction box in sub-floor immediately below panel. Run flexible conduit from junction box to outlet boxes for each computer in sub-floor.
 - .18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
 - .19 Mechanically bend steel conduit over 19 mm dia.
 - .20 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
 - .21 Install fish cord in empty conduits.
 - .22 Run 2 - 25 mm spare conduits up to ceiling space and 2 - 25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.
 - .23 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
 - .24 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 On Completion and verification of performance of installation, remove surplus materials, excess materials rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.1 No. 126.1 – Metal Cable Tray Systems.
- .2 National Electrical Manufacturers Association (NEMA).
 - .1 NEMA FG 1, Fibreglass and Cable Tray Systems.
 - .2 NEMA VE 1, Metal Cable Tray Systems.

1.3 SUBMITTALS

- .1 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.
- .2 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.
- .3 Identify types of cabletroughs used.
- .4 Show actual cabletrough installation details and suspension system.

2.0 PRODUCTS

2.1 CABLETROUGH

- .1 Cable troughs and fittings: to NEMA FG 1 and VE 1 as referenced in Item 1.2.2 above..
- .2 Ladder type, Class A, C1, D1 or E as indicated in CAN/CSA C22.2 No.126.
- .3 Trays: extruded aluminum, width and depth as indicated.
- .4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable trough supplied.
 - .1 Radii on fittings: 900 mm minimum.

- .5 Solid covers for complete cable trough system including fittings.
- .6 Barriers where different voltage systems are in same cable trough.

2.2 SUPPORTS

- .1 Provide supports as indicated.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install complete cable trough system.
- .2 Support cable trough on both sides.
- .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLETROUGH

- .1 Install cables individually.
- .2 Lay cables into cable trough. Use rollers when necessary to pull cables.
- .3 Secure cables in cable trough at 6 m centres, with nylon ties.
- .4 Identify cables every 30 m with size 2 nameplates in accordance with Section 26 05 00 – Common Work Results - Electrical.

END OF SECTION

1.0 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

2.0 PRODUCTS**2.1 WIREWAYS**

- .1 Wireways and fittings: to CSA C22 No. 26.
- .2 Sheet steel with hinged and bolted cover to give uninterrupted access.
- .3 Finish: baked grey enamel.
- .4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

3.0 EXECUTION**3.1 INSTALLATION**

- .1 Install wireways and auxiliary gutters.
- .2 Keep number of elbows, offsets, connections to minimum.
- .3 Install supports, elbows, tees, connectors, fittings.
- .4 Install barriers where required.
- .5 Install gutter to full length of equipment.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 74 19 – Construction Waste Management and Disposal.
- .2 Section 01 91 13 - Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association, (CSA)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

2.0 PRODUCTS

2.1 CABLE PROTECTION

- .1 38 x 140 mm planks pressure treated with copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

- .1 Wooden post type markers: 89 x 89 mm, 1.5 m long, pressure treated with copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.
 - .1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

3.0 EXECUTION

3.1 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
 - .1 Do not pull spliced cables inside ducts.
- .2 Install multiple cables in duct simultaneously.
- .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

- .4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.

3.2 MARKERS

- .1 Mark cable every 150 m along cable runs and changes in direction.
- .2 Mark underground splices.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .4 Install wooden post type markers.
- .5 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.

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- .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at 100 % of original factory test voltage in accordance with manufacturer's recommendations.
 - .4 Leakage Current Testing.
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by manufacturer.
 - .3 Record leakage current at each step.
 - .7 Provide Region's Representative with list of test results showing location at which each test was made, circuit tested and result of each test. Include results in Commissioning Manual.
 - .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

1.0 GENERAL

1.1 SCOPE

- .1 The Contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer or an approved engineering firm.
- .2 The Contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in CSA Z462 – Workplace Electrical Safety.
- .3 The scope of the studies shall include all distribution and equipment.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
 - .2 ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.
 - .3 ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
 - .4 ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
- .2 CSA Group (CSA)
 - .1 CSA Z462-15 – Workplace Electrical Safety.
- .3 Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - .1 IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.
 - .2 IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings.
 - .3 IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
 - .4 IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.

- .5 IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
- .6 IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations.
- .4 The National Fire Protection Association (NFPA)
 - .1 NFPA 70 - National Electrical Code.
 - .2 NFPA 70E – Standard for Electrical Safety in the Workplace.

1.3 SUBMITTALS FOR REVIEW/APPROVAL

- .1 The short-circuit and protective device coordination studies shall be submitted to the Region's Representative prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing and/or project schedule, approval from the Region's Representative may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

1.4 SUBMITTALS FOR CONSTRUCTION

- .1 The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report.
- .2 The report shall include the following sections:
 - .1 One-line diagram showing protective device ampere ratings and associated designations, cable size and lengths, transformer kVA and voltage ratings, motor and generator kVA ratings, and switchgear/switchboard/panelboard designations.
 - .2 Descriptions, purpose, basis and scope of the study.
 - .3 Tabulations of the worst-case calculated short circuit duties as a percentage of the applied device rating (automatic transfer switches, circuit breakers, fuses, etc.); the short circuit duties shall be upward-adjusted for X/R ratios that are above the device design ratings.
 - .4 Protective device time versus current coordination curves with associated one line diagram identifying the plotted devices, tabulations of ANSI protective relay functions and adjustable circuit breaker trip unit settings.
 - .5 Fault study input data, case descriptions, and current calculations including a definition of terms and guide for interpretation of the computer printout.
 - .6 Incident energy and flash protection boundary calculations.

- .7 Comments and recommendations for system improvements where needed.
- .8 Executive Summary including source of information and assumptions made.

1.5 QUALIFICATIONS

- .1 The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- .2 The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm and be registered to practice in the Province of Ontario.
- .3 The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.
- .4 The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed.

2.0 PRODUCTS

2.1 STUDIES

- .1 Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer or an approved engineering firm. The coordination new and/or modified study shall begin with the utility company's feeder protective device and include all of the electrical protective devices down to and include the largest feeder circuit breaker in the 208 Volt panelboards. Study shall also include variable frequency drives, harmonic filters, power factor correction equipment, transformers and protective devices associated with variable frequency drives, emergency standby generator and distribution switchgear.
- .2 The Contractor shall furnish an Arc Flash Hazard Analysis Study per CSA Z462.

2.2 DATA COLLECTION

- .1 Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

- .2 Source combination may include present and future utility supplies, motors, and generators.
- .3 If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

- .1 Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141, latest edition.
- .2 Transformer design impedances and standard X/R ratios shall be used when test impedances are not available.
- .3 Provide the following:
 - .1 Calculation methods and assumptions.
 - .2 Selected base per unit quantities.
 - .3 One-line diagram of the system being evaluated with available fault at each bus, and interrupting rating of devices noted.
 - .4 Source impedance data, including electric utility system and motor fault, contribution characteristics.
 - .5 Tabulations of calculated quantities.
 - .6 Results, conclusions, and recommendations.
- .4 Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
 - .1 Electric utility's supply termination point.
 - .2 Incoming switchgear.
 - .3 Unit substation primary and secondary terminals.
 - .4 Low voltage switchgear.
 - .5 Standby generators and automatic transfer switches.
 - .6 Branch circuit panelboards.
 - .7 Other significant locations throughout the system.
- .5 For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

.6 Protective Device Evaluation:’

- .1 Evaluate equipment and protective devices and compare to short circuit ratings.
- .2 Adequacy of switchgear, motor control centers, and panelboard bus bracing to withstand short-circuit stresses.
- .3 Adequacy of transformer windings to withstand short-circuit stresses.
- .4 Cable and busway sizes for ability to withstand short-circuit heating.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

- .1 Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
- .2 Include on each curve sheet, a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- .3 Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
- .4 Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- .5 Plot the following characteristics on the curve sheets, where applicable
 - .1 Electric utility’s overcurrent protective device.
 - .2 Medium voltage equipment overcurrent relays.
 - .3 Medium and low voltage fuses including manufacturer’s minimum melt, total clearing, tolerance, and damage bands.
 - .4 Low voltage equipment circuit breaker trip devices, including manufacturer’s tolerance bands.
 - .5 Transformer full-load current, magnetizing inrush current, and ANSI through- fault protection curves.
 - .6 Conductor damage curves.
 - .7 Ground fault protective devices, as applicable.
 - .8 Pertinent motor starting characteristics and motor damage points, where applicable.
 - .9 Pertinent generator short-circuit decrement curve and generator damage point

- .6 Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH HAZARD ANALYSIS

- .1 The arc flash hazard analysis shall be performed according to CSA Z462.
- .2 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, panelboards, busway and splitters) where work could be performed on energized parts.
- .3 The Arc-Flash Hazard Analysis shall include all new and/or modified equipment where work could be performed on energized parts.
- .4 Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².
- .5 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.
- .6 The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating.
- .7 The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
 - .1 Fault contribution from induction motors should not be considered beyond 3-5 cycles.
 - .2 Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- .8 For each equipment location with a separately enclosed main device (where there

is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

- .9 Where performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- .10 Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- .11 Arc Flash calculations shall be based on actual overcurrent protective device clearing time.

2.6 REPORT SECTIONS

- .1 Input data shall include but not be limited to the following:
 - .1 Utility 3-phase and L-G available contribution with associated X/R ratios.
 - .2 Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
 - .3 Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.
 - .4 Reactor data, including voltage rating, and impedance.
 - .5 Generation contribution data, (synchronous generators and Utility), including short-circuit reactance (X''_d), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.
 - .6 Motor contribution data (induction motors and synchronous motors), including short circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.
- .2 Short-Circuit Output Data shall include, but not be limited to the following reports:
 - .1 Low voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each application location:
 - .1 Voltage

-
- .2 Calculated fault current magnitude and angle
 - .3 Fault point X/R ratio
 - .4 Equivalent impedance
 - .2 Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
 - .1 Voltage
 - .2 Calculated symmetrical fault current magnitude and angle
 - .3 Fault point X/R ratio
 - .4 Calculated asymmetrical fault currents
 - .1 Based on fault point X/R ratio
 - .2 Based on calculated symmetrical value multiplied by 1.6
 - .3 Based on calculated symmetrical value multiplied by 2.7
 - .5 Equivalent impedance.
 - .3 Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
 - .1 Voltage.
 - .2 Calculated symmetrical fault current magnitude and angle.
 - .3 Fault point X/R ratio.
 - .4 No AC Decrement (NACD) Ratio.
 - .5 Equivalent impedance.
 - .6 Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis.
 - .7 Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis.
 - .3 Recommended Protective Device Settings:
 - .1 Phase and Ground Relays:

- .1 Current transformer ratio.
- .2 Current setting.
- .3 Time setting.
- .4 Instantaneous setting.
- .5 Recommendations on improved relaying systems, if applicable.
- .2 Circuit Breakers:
 - .1 Adjustable pickups and time delays (long time, short time, ground)
 - .2 Adjustable time-current characteristic.
 - .3 Adjustable instantaneous pickup.
 - .4 Recommendations on improved trip systems, if applicable.
- .3 Incident energy and flash protection boundary calculations:
 - .1 Arcing fault magnitude.
 - .2 Protective device clearing time.
 - .3 Duration of arc.
 - .4 Arc flash boundary.
 - .5 Working distance.
 - .6 Incident energy.
 - .7 Hazard Risk Category.
 - .8 Recommendations for arc flash energy reduction.

3.0 EXECUTION

3.1 FIELD ADJUSTMENT

- .1 Adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- .2 Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- .3 Notify Region's Representative in writing of any required major equipment modifications.

3.2 ARC FLASH WARNING LABELS

- .1 The contractor of the Arc Flash Hazard Analysis shall provide a 90 mm x 617 mm thermal transfer type label of high adhesion polyester for each work location analyzed.
- .2 All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the Region's Representative and after any system changes, upgrades or modifications have been incorporated in the system.
- .3 The label shall have an orange header with the working: "WARNING: ARC FLASH HAZARD" and shall include the following information, at a minimum:
 - .1 Location designation
 - .2 Nominal voltage
 - .3 Flash protection boundary
 - .4 Hazard risk category
 - .5 Incident energy
 - .6 Working distance
 - .7 Engineering report number, revision number and issue date.
- .4 Labels shall be machine printed, with no field markings.
- .5 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
 - .1 For each 600 and 208 volt panelboard, one arc flash label shall be provided.
 - .2 For each motor control center, one arc flash label shall be provided.
 - .3 For each low voltage switchboard, one arc flash label shall be provided.
 - .4 For each switchgear, one flash label shall be provided.
 - .5 For medium voltage switches one arc flash label shall be provided.

3.3 EXECUTION

- .1 Coordinate requirements of this Section with information contained in and as follows:
- .2 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.

- .3 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
- .4 Disconnect and remove existing fire alarm system including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
- .5 Disconnect and remove communication systems including associated conduits, boxes, cabling, and similar items unless specifically noted otherwise.
- .6 Disconnect and remove telephone outlets, associated conduit, cabling and sub terminal backboards and related accessories; maintain telephone service and main terminal backboard as is.
- .7 Perform demolition work in a neat and workmanlike manner:
- .8 Remove tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
- .9 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
- .10 Disconnect panel feeders back to main distribution panel and re label respective circuit breaker as “SPARE”.
- .11 Place weatherproof blank cover plates on exterior outlet boxes remaining after demolition and removal activities.
- .12 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices and equipment.
- .13 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
- .14 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.4 CLOSEOUT ACTIVITIES

- .1 Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for re use in new construction.

END OF SECTION

1.0 GENERAL

1.1 SCOPE OF WORK

- .1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

1.2 SECTION INCLUDES

- .1 Commissioning of all building electrical systems and component including:
 - .1 Testing and adjustment.
 - .2 Demonstrations and Training.
 - .3 Instructions of all procedures for Region Representative's personnel.
 - .4 Updating as-built data.
 - .5 Co-ordination of Operation and Maintenance material.

1.3 RELATED SECTION

- .1 Section 01 78 00 – Closeout Submittals.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.4 REFERENCES

- .1 CSA (Canadian Standards Association).
- .2 Underwriters Laboratories of Canada.

1.5 QUALITY ASSURANCE

- .1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.
- .2 Submit the names of all personnel to be used during the Commissioning activities for Region's Representative Approval.

1.6 COMMISSIONING

- .1 The purpose of the commissioning process is to fully test all building systems including architectural, mechanical and electrical components and operating

procedures by challenging these systems to realistic operation conditions.

- .2 The Commissioning activities shall be coordinated by the General Contractor.
- .3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.
- .4 Contractor shall be responsible to update all documentation with information and any changes duly noted during the Commissioning exercise.
- .5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

1.7 SUBMITTALS

- .1 A commissioning document shall be prepared by the Region's Representative prior to conducting these activities for use by the Commissioning Team.
- .2 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and coordinated through the General Contractor.
- .3 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.8 PREPARATION

- .1 Provide test instruments required for all activities as defined in the commissioning documents.
- .2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the recommissioning check out operation.
- .3 Confirm all scheduled activities have identified personnel available.
- .4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

1.9 SYSTEM DESCRIPTION

- .1 Perform all start up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.

- .2 Region's Representative will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.
- .3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.
- .4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .5 Conduct presentation on Region Representative's premises. Region's Representative will provide space.

1.10 FINAL REPORT

- .1 This trade shall assemble all testing data and commissioning reports and submit them to the Region's Representative.
- .2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

1.11 SCHEDULE OF ACTIVITIES

- .1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team, refer to Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.
- .3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close co-ordination of this schedule is important.
- .4 In the event project cannot be commissioned in the allotted time slot, the Contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the Contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

2.0 PRODUCTS (NOT APPLICABLE)

3.0 EXECUTION (NOT APPLICABLE)

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials, components, cabinets, instruments and installation for metering and switchboard Instruments.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C39.1, Requirements, Electrical Analog Indicating Instruments.
- .2 Canadian Standards Association, (CSA)
 - .1 CAN3-C17, Alternating - Current Electricity Metering.

1.4 PRODUCT DATA

- .1 Indicate meter, and instrument, outline dimensions, panel drilling dimensions and include cutout template.

2.0 PRODUCTS

2.1 METER

- .1 Combination energy and demand meter: to CAN3-C17- AC Electricity Metering.
- .2 Accuracy: $\pm 2\%$.
- .3 'S' socket, 'A' base, bottom connected, rectangular, flush switchboard case, indoor. Ratings: as indicated.
- .5 Register: self contained, pulse contacts for transmitting signal.
- .6 Provision for remote sensing.

2.2 METER SOCKET

- .1 Meter socket to suit meter with automatic current transformer shorting devices when meter removed.

2.3 METER CABINET

- .1 Sheet steel CSA enclosure with meter backplate, to accommodate meters, test terminal block and associated equipment, factory installed and wired.

2.4 METERING INSTRUMENT TRANSFORMER CABINET

- .1 Sheet steel CSA enclosure to accommodate potential and current transformers.

2.5 TEST TERMINAL BLOCKS

- .1 Test terminal blocks: as required.

2.6 INDICATING INSTRUMENTS

- .1 Analogue or digital indicating instruments: to ANSI C39.1, Electrical Analogue Indicating Instruments, 1% accuracy, switchboard mounting, flush, case size 87 by 112 mm rectangular 180° scale, operated from shunt current transformer.
 - .1 Ammeter: true RMS range as indicated to suit project requirement.
 - .2 Voltmeter: true RMS range 0-250 V a.c. and 0-600 V a.c., as indicated.
 - .3 Wattmeter: range as indicated.
 - .4 Varmeter: range as indicated.
 - .5 Frequency meter: range 0-60 Hertz.
 - .6 Power factor meter: range 0-1.0.

2.7 INSTRUMENT SELECTOR SWITCHES

- .1 Voltmeter and Ammeter selector switches: rotary, multi-position, maintained contacts, panel mounting, round notched handle, rated to suit instruments, nameplate marked as indicated to coincide with each rotary position. Ammeter selector switches designed to preclude opening of current circuits.
- .2 Four position ammeter selector switches identified "off-A-B-C".
- .3 Four position voltmeter selector switches identified "A-B, B-C, C-A, off".
- .4 Seven position voltmeter selector switches identified "A-B, B-C, C-A, off, A-N, B-N, C-N".

2.8 SHOP INSTALLATION

- .1 Install meters and instrument transformers in separate compartment of switchboard.

- .2 Install instruments on switchboard.
- .3 Ensure adequate spacing between current transformers installed on each phase.
- .4 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

3.0 EXECUTION

3.1 METERING INSTALLATION

- .1 Install meters and instruments in location free from vibration and shock.
- .2 Make connections in accordance with diagrams.
- .3 If applicable, ensure power factor corrective equipment connected on load side of meter.
- .4 Connect meter and instrument transformer cabinets to ground.
- .5 Locate meters within 9 m of instrument transformers. Use 32 mm conduit for interconnections. Use separate conduit for each set of current transformer connections, exclusive for metering.

3.2 FIELD QUALITY CONTROL

- .1 Conduct tests in accordance with Section 26 05 00 - Common Work Results – Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements and in accordance with manufacturer's recommendations.
- .2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.
- .3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.
- .4 Perform tests to obtain correct calibration.
- .5 Do not dismantle meters and instruments.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .4 Section 26 05 00 – Common Work Results - Electrical.

2.0 PRODUCTS

2.1 PHOTOELECTRIC LIGHTING CONTROL

- .1 Wall mounting.
- .2 Capable of switching 1800 W of lighting at 120 V.
- .3 Voltage variation: plus or minus 10%.
- .4 Temperature range: minus 40 °C to plus 40° C.
- .5 Switching on lights at 1-5 lx.
- .6 Switching off lights at 6-15 lx.
- .7 Rated for 5000 operations.
- .8 Options:
 - .1 Lightning arrester.
 - .2 Fail-safe circuit completed when relay de-energized.
 - .3 Twist-lock type receptacle.
 - .4 Terminal strip.
 - .5 Sensitivity adjustment.
- .9 Switching time delay of 30 s.
- .10 Wall mounting bracket.
- .11 Colour coded leads: size 10 AWG, 460 mm long.

2.2 CONTACTOR

- .1 Cabinet mounting.
- .2 Capable of switching multiple lamp circuits with total lighting load of 6000 W.
- .3 Waterproof enclosure.
- .4 Manual override.

3.0 EXECUTION**3.1 INSTALLATION**

- .1 Install photoelectric controls in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 - Commissioning (Cx) Requirements.
- .2 Actuate control unit in presence of Region's Representative to demonstrate lighting circuits are controlled as designated.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.184.1, Solid-State Dimming Controls (Bi-national standard with UL 1472).

1.3 SUBMITTALS

- .1 Submit WHMIS MSDS - Safety Data Sheets. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .2 Submit product data sheets for incandescent lighting dimming control equipment. Include product characteristics, performance criteria, physical size, limitations and finish.
- .3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

2.0 PRODUCTS

2.1 FULL RANGE DIMMER

- .1 Full range dimmer: to CSA C22.2 No.184.1, packaged in accordance with Canadian Code for Preferred Packaging guidelines, designed to produce 0% to 100% brightness control by means of single dial and to provide smooth and continuous square law dimming curve, and:
 - .1 Fit single-gang standard switch box.
 - .2 Gangable without removing side sections or derating capacity.
 - .3 Advanced solid-state circuitry providing symmetrical ac wave form to input of low voltage magnetic ballasts, when used.
 - .4 Two moving parts:
 - .1 Single pole switch.

- .2 Long life potentiometer.
- .5 Push to turn ON or OFF without disturbing preselected brightness setting.
- .6 Rated: 1600 W at 120 V, ac.
- .7 Voltage regulated to maintain plus or minus 5% light output variation with plus or minus 10% line voltage variation.
- .8 No perceptible flicker at any point in dimming range and no perceptible humming.
- .9 Audio/Radio/TV interference filter.
- .10 Operate at ambient temperature of 0 to 40 °C.

2.2 COMMERCIAL DIMMERS

- .1 Commercial dimmers: to CSA C22.2 No.184.1, packaged in accordance with Canadian Code for Preferred Packaging guidelines, designed to control brightness of incandescent lamps up to 2.4 kW, single phase or 3.6 kW, three phase and consisting of:
 - .1 Intensity control kit.
 - .2 Power sections.
 - .3 Manual control.
 - .4 Motorized control unit.
 - .5 Remote control station.
 - .6 Remote monitor station.
 - .7 Master Control station.
- .2 Intensity control kit:
 - .1 Single or three phase, 120, 120/208 V.
 - .2 Solid state circuitry.
 - .3 Intensity control station and one or three circuit cords to mount in Master Power Section s c/w surge protection.
 - .4 On-off switch.
 - .5 Single phase unit mounts in single gang switch box.

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- .6 Three phase unit mounts in two gang switch box.
 - .7 Power input: 6 A at 120 V ac, 60 Hz.
 - .3 Power sections:
 - .1 Basic dimmer control.
 - .2 Two, single-pole, 20 A, magnetic only circuit breakers to supply output circuits.
 - .3 Lamp debuzzing coil to eliminate lamp buzzing and radio frequency interference.
 - .4 Rated: 2400 W at 120 V, 60 Hz, with status light.
 - .4 Manual control for dimming from single location as indicated.
 - .5 Motorized control for dimming from remote locations as indicated.
 - .1 Standard intensity master control mechanically coupled to motor drive unit with status light.
 - .6 Remote control station:
 - .1 Remote control switch increases-decreases brightness, momentary action, center position off. Fits single gang switch box.
 - .2 Remote control switch increases-decreases brightness, momentary action, center position off, plus meter calibrated 0 to 100% brilliance, and pilot light that glows with same relative brilliance as lamps being controlled. Fits double gang switch box.
 - .3 Number of stations as indicated.
 - .4 Preset remote dimming control with 4 light scenes and 4 independent lighting zones with each scene.
 - .1 Four touch buttons activate corresponding scenes.
 - .2 Separate button turns off control unit.
 - .7 Remote monitor station:
 - .1 Used to observe lamp brilliance from location out of sight, as indicated.
 - .2 Meter calibrated 0 to 100% brilliance.

- .3 Pilot light glows with same relative brilliance as lamps being controlled; fits single gang switch box.
- .8 Master control station:
 - .1 Controls up to 4 motorized systems from single remote point as indicated.
 - .2 Each motorized system has option of being operated independently from its remote control station.
 - .3 Next to each control, status light indicator to display status of each element controlled.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install dimmers and remote control stations in accordance with manufacturer's instructions.
- .2 Connect lamp circuits to dimmer power sections.
- .3 Install remote monitoring station.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Demonstrate that dimming systems are installed as indicated.
- .3 Demonstrate that dimming systems operate as intended and that there are no problems in starting lamps, nor in keeping them lit and flicker-free at any setting of dimming intensity control.
- .4 Demonstrate that no audio, radio or TV interference is carried by system.

END OF SECTION

1.0 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results - Electrical.
- .4 Section 26 50 00 - Lighting.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.184.1, Solid-State Dimming Controls (Bi-national standard with UL 1472).

1.3 SUBMITTALS

- .1 Submit WHMIS MSDS - Safety Data Sheets. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .2 Submit product data sheets for fluorescent lighting control equipment. Include product characteristics, performance criteria, physical size, limitations and finish.
- .3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.
- .4 Indicate shielded wiring requirements.

2.0 PRODUCTS**2.1 EQUIPMENT - GENERAL**

- .1 Dimming system: to CSA C22.2 No.184.1, packaged in accordance with the Canadian Code for Preferred Packaging guidelines, components to be from one manufacturer, and to comprise an integrated system.
- .2 System to start, and operate continuously, within intensity setting of 20 to 100%.
- .3 System to include approved radio, VCR and TV interference suppressors.
- .4 System voltage as indicated.

2.2 INTENSITY SELECTOR

- .1 Intensity selector unit, containing solid state firing circuit, master potentiometer, manually operated, motorized for remote control, providing for continuous adjustment from maximum intensity, to 20 % of maximum intensity, and actuating up to 100 multiple dimming auxiliaries, suitable for installation in three gang wall box and complete with knob and faceplate.

2.3 ON-OFF SWITCH

- .1 On-off switch mounted in same wall box as intensity selector.

2.4 DIMMING AUXILIARIES

- .1 Dimming auxiliaries, to control 4 or 6 multiple dimming ballasts, suitable for mounting in lighting fixture as required.

2.5 BALLASTS

- .1 To Section 26 50 00 - Lighting.

2.6 RELAYS, CONTACTORS

- .1 Enclosed solid-state relays, contactors and controls for multipoint control.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install components comprising dimming system in accordance with manufacturer's instructions, and as indicated.
- .2 Install wiring, shielding, grounding in accordance with manufacturer's instructions.
- .3 Ensure shielded leads between intensity selector potentiometer and intensity controls have outer insulating jackets and are connected to ground at one point only.
- .4 Keep radio, VCR, TV and intercom wiring a minimum of 1.8 m away from dimming circuitry. Where crossing of wiring is essential, ensure that grounded shields surround such intercom wiring, and that crossings take place at 90°.
- .5 Locate intensity controls and "on-off" switches as indicated.
- .6 Ensure positive, low resistance lamp to pin contact within lampholder.

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- .7 Age lamps by operating at full intensity for 100 h prior to final inspection. Operate ballasts in ambient temperature above 18°C.
 - .8 Ensure connections are correctly made and to same phase before energizing.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Demonstrate that dimming systems are installed as indicated.
- .3 Demonstrate that dimming systems operate as intended and that there are no problems in starting lamps, nor in keeping them lit, and free of perceptible flicker at any setting of dimming intensity control.
- .4 Demonstrate that no radio, VCR or TV interference is carried by system and that there is no interference between dimming system and locally used infrared-based remote/integral controls.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 61 00 – Common Product Requirements.
- .3 Section 01 78 00 – Closeout Procedures.
- .4 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .5 Section 26 05 00 – Common Work Results - Electrical.

1.2 SYSTEM DESCRIPTION

- .1 Low voltage control system designed to provide remote switching of lighting loads by use of:
 - .1 Low voltage momentary contact switches
 - .2 Low voltage relays.
 - .3 Control transformers
 - .4 Low voltage rectifiers
 - .5 Manual switch control.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS).
- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

- .3 Closeout Submittals:
 - .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .4 Test reports:
 - .1 Submit certified test reports indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions.
 - .4 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 DELIVERY, STORAGE, AND HANDLING

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

2.0 PRODUCTS

2.1 MATERIALS

- .1 Control system: by one manufacturer and assembled from compatible components.

2.2 REMOTE CONTROL SWITCHES

- .1 Single pole, double throw, momentary contact, heavy duty, rated 3 A, 25 V, centre pivot rocker action with pilot lights where indicated.

2.3 LOW VOLTAGE RELAYS

- .1 Electrically operated by momentary impulse, mechanically latched until activated.
- .2 Two coil solenoid type with one coil to close relay contacts and one coil to open relay contacts.
- .3 Operating voltage: 24 V, AC.
- .4 Load contacts: 20 A, 120 or 347 V, AC as indicated.
- .5 Auxiliary contacts for pilot light.
- .6 Coloured pre-stripped leads.

2.4 CONTROL TRANSFORMER

- .1 Low voltage power Class 2, input 120 or 347 V, AC, 60 Hz, output 35 VA at 24 V.

2.5 RECTIFIER

- .1 Selenium type: 24 V, AC, 60 Hz input, 0.36 A continuous duty output.
- .2 Silicon type: 24 V, AC, 60 Hz input, 7.5 A continuous duty output.

2.6 MANUAL CONTROL

- .1 Individual remote control switches as indicated.
- .2 Eight circuit manual master selector switch mounted in 100 mm square box with:
 - .1 Master lock-out switch
 - .2 Individual red jewelled pilot lights.
- .3 Nine circuit manual dial-type master selector.
- .4 Twelve circuit manual dial-type master selector.

2.7 MOTOR OPERATED MASTER CONTROL

- .1 Motor-driven multiple contact momentary switching device.
- .2 Radial contact arm to rotate through one revolution in 17 s.
- .3 Contact made in succession between 25 points around circle.
- .4 One master required for "ON" operation and one for "OFF" operation.

- .5 Motor master units connected in cascade to control circuits as indicated.
- .6 Interface equipment as required to convert maintained contact signals to momentary contact control pulses.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Actuate control units in presence of Region's Representative to demonstrate lighting circuits are controlled as designated.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials for indoor and outdoor isolating switches.
- .2 Edit this section to suit project requirements.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No. 58, High-Voltage Isolating Switches.
- .2 National Electrical Manufacturers Association (NEMA)

1.4 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for isolating switches for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Technical data to cover operating mechanism of group operated switches.

2.0 PRODUCTS

2.1 ISOLATING SWITCH

- .1 Isolating switch: to CSA C22.2 No.58.
- .2 Outdoor, single pole, vertical or horizontal load break with arcing horns, structure mounted, continuous current and voltage rating as indicated, manual operating mechanism, key interlocked.
- .3 Outdoor, single pole, single throw hook operated disconnect, structure mounted, continuous rating as indicated on drawings.
- .4 Outdoor, three pole, vertical or horizontal load break with arcing horns, group operated, structure mounted, continuous rating as indicated, manual operating or motor driven mechanism, key interlocked, as indicated.
- .5 Indoor, three pole, vertical breaks, group operated, cubicle mounted, continuous rating as indicated, manual operating mechanism, key interlocked.
- .6 Outdoor, single pole, quick break, hook stick operated enclosed disconnect with

porcelain housing and glass-reinforced polyester door, structure mounted, continuous rating as indicated.

- .7 Outdoor, single pole, hook stick operated line switch with flanged steel channel base, distribution post type insulators, locking latch to prevent opening from vibration, structure mounted, continuous rating as indicated on drawings.
- .8 Outdoor single pole, hook stick operated station switch with universal base designed for variety of mounting positions, NEMA TRN insulators, locking latch to prevent opening from vibration, continuous rating as indicated.

3.0 EXECUTION

NOT USED

END OF SECTION

1.0 GENERAL**1.1 SECTION INCLUDES**

- .1 Materials and installation for low voltage switchgear for controlling relatively large loads - 2000 A or larger.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .4 Section 26 05 00 – Common work Results - Electrical.
- .5 Section 26 09 23.01 – Metering and Switchboard Instruments.
- .6 Section 26 24 02 – Service Entrance Board.
- .7 Section 26 24 05 – Service Entrance TVSS Protection.
- .8 Section 26 28 16.01 – Air Circuit Breakers.
- .9 Section 26 28 16.02- Molded Case Circuit Breakers.
- .10 Section 26 28 18- Ground Fault Equipment Protection.
- .11 Section 26 28 23- Disconnect Switches – Fused and Non-fused.
- .12 Section 26 41 00.02 – Secondary Lighting Arresters.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.31, Switchgear Assemblies.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC G8-3.3, Metal-Enclosed Interrupter Switchgear Assemblies.

1.4 SUBMITTALS

- .1 Indicate on shop drawings:
 - .1 Floor anchoring method and foundation template.
 - .2 Dimensioned cable entry and exit locations.

- .3 Dimensioned position and size of bus.
- .4 Overall length, height and depth of complete switchgear.
- .5 Dimensioned layout of internal and front panel mounted components.
- .2 Indicate on product data:
 - .1 Time-current characteristic curves for air circuit breakers.

1.5 QUALITY ASSURANCE

- .1 Submit 3 copies of certified factory test results. Include with Commissioning Manual as specified in Section 01 91 13 – General Commissioning (Cx) Requirements.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for secondary switchgear for incorporation into manual in accordance with Section 01 78 00 - Closeout Submittals.
- .2 3 copies maintenance data for complete switchgear assembly including components.

1.7 STORAGE AND PROTECTION

- .1 Store switchgear on site in protected, dry location. Cover with plastic to keep off dust.
- .2 Provide energized strip heater in each cell to maintain dry condition during storage.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Switchgear assembly: to EEMAC G8-3.3 CAN/CSA-C22.2 No.31.

2.2 RATING

- .1 Secondary switchgear: indoor, rated as indicated on electrical drawings, 3 phase, 4 wire, 60 Hz, minimum short circuit capacity 18 kA (rms symmetrical), as indicated.

2.3 ENCLOSURE

- .1 Main incoming section to contain:
 - .1 Air circuit breaker sized as indicated to Section 26 28 16.01 – Air Circuit Breakers.

- .2 Ammeter and selector switch.
- .3 Voltmeter and selector switch.
- .4 Demand meter.
- .5 Provision for electrical power supply authority metering.
- .2 Distribution sections to contain:
 - .1 Air circuit breaker sized as indicated to Section 26 28 16.01 – Air Circuit Breakers.
 - .2 Tin plated aluminum bus, from main section to distribution sections including vertical bussing.
 - .3 Blanked off spaces for future units.
 - .4 Metal enclosed, free standing, floor mounted, dead front, indoor, CSA Enclosure 1 cubicle unit, sprinkler proof as required.
 - .5 Ventilating louvres: vermin, insect proof (with easily replaceable fibre glass filters.)
 - .6 Access from front and rear.
 - .7 Steel channel sills for base mounting in single length common to multi-cubicle switchboard.
 - .8 Provision for future extension on both sides.
 - .9 Interior lighting: 100 W lamp in porcelain lampholder in each cubicle with externally mounted switch and pilot light.
 - .10 Receptacle: 120 V, single phase, 60 Hz, duplex, U-ground, in each cubicle.

2.4 BUSBARS

- .1 Three phase and full capacity neutral bare busbars, continuous current rating as indicated. A self-cooled, extending full width of multi-cubicle switch board, suitably supported on insulators.
- .2 Main connections between bus and major switching components to have continuous current rating to match major switching components.
- .3 Busbars and main connections: 99.30% conductivity aluminum.
- .4 Provision for extension of bus on both sides of unit without need for further drilling or preparation in field.
- .5 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

- .6 Identify phases of busbars by suitable marking.
- .7 Busbar connectors, when switchboard shipped in more than one section.

2.5 GROUNDING

- .1 Copper ground bus not smaller than 50 x 6 mm extending full width of multi-cubicle switchboard and situated at bottom.
- .2 Lugs at each end for size 4/0 AWG grounding cable.

2.6 GROUND FAULT UNIT

- .1 Reference Section 26 28 18- Ground Fault Equipment Protection.

2.7 AIR CIRCUIT BREAKER

- .1 Reference Section 26 28 16.01 – Air Circuit Breakers.

2.8 MOULDED CASE CIRCUIT BREAKERS

- .1 Reference Section 26 28 16.02- Moulded Case Circuit Breakers.

2.9 FUSIBLE DISCONNECTS AND FUSES

- .1 Reference Section 26 28 23- Disconnect Switches – Fused and Non-fused.

2.10 INSTRUMENTS AND TRANSFORMERS

- .1 Reference Section 26 09 23.01 – Metering and Switchboard Instruments.

2.11 REGION REPRESENTATIVE’S METERING

- .1 Reference Section 26 24 02 – Service Entrance Board, par. 2.7 – Region’s Representatives Metering.

2.12 LIGHTNING ARRESTERS

- .1 Refer to Section 26 41 00.02 – Secondary Lighting Arresters.

2.13 POWER SUPPLY AUTHORITY METERING

- .1 Separate compartment and metal raceway for exclusive use of power supply authority metering.
- .2 Provide mounting accessories and wiring for metering as follows:
 - .1 3 potential transformers.

- .2 3 current transformers.
- .3 Watthour meter.
- .4 Demand meter with kW.h register.
- .5 Ammeter.
- .6 Voltmeter.
- .7 Ammeter phase selector switch.
- .8 Voltmeter phase selector switch.
- .3 Coordinate supply and installation of current and potential transformers for utility metering with utility representative. Carry all associated costs.

2.14 FINISHES

- .1 Apply finishes in accordance with Section 26 05 00 – Common Work Results - Electrical.
 - .1 Cubicle exteriors grey.
 - .2 Cubicle interiors white.

2.15 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplates:
 - .1 White plate, black letters, size 7.
 - .2 Complete switchgear labelled: as indicated. "
 - .3 Main cubicle labelled: "Main Breaker ".
 - .4 Distribution units labelled: "as indicated".

2.16 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

- .1 Reference Section 26 24 05 – Service Entrance TVSS Protection.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Locate switchgear assembly as indicated and bolt to floor.

- .2 Coordinate supply and installation of current and potential transformers for utility metering with utility representative.
- .3 Connect main secondary power supply to main breaker.
- .4 Connect load side of breakers or disconnects in distribution cubicles to distribution feeders.
- .5 Run one grounding conductor 4/0AWG bare copper in 25 mm conduit from ground bus to main station ground bus.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Carry out following insulation tests using megger with 20,000 megohm scale and resulting insulation resistance corrected to base of 20 degrees Celsius.
 - .1 High voltage to ground with secondary grounded for duration of test.
 - .2 Low voltage to ground with primary grounded for duration of test.
 - .3 High to low voltage.
- .3 Inspect primary and secondary connections for tightness and for signs of overheating.
- .4 Check fuse sizes and trip unit settings, against co-ordination study to ensure proper working and protection of components.
- .5 Inspect and clean bushings and insulators.
- .6 Check temperature indicators.
- .7 Inspect for excessive rusting.
- .8 Check fuses for correctness of type and size.
- .9 Check operation of Region Representative's metering.

END OF SECTION

1.0 GENERAL**1.1 SECTION INCLUDES**

- .1 Service equipment and installation.

1.2 RELATED SECTIONS

- .1 Section 26 05 28 - Grounding - Secondary.
- .2 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .3 Section 26 24 16.01 - Panelboards - Breaker Type.
- .4 Section 26 24 16.02 - Panelboards - Switch and Fuse Type.
- .5 Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .6 Section 26 28 23 - Disconnect Switches - Fused and Non-Fused.
- .7 Section 26 28 20 - Ground Fault Circuit Interrupters - Class "A".

2.0 PRODUCTS**2.1 EQUIPMENT**

- .1 Fused disconnect switch: in accordance with Section 26 28 23 - Disconnect Switches - Fused and Non-Fused, rating as indicated.
- .2 Enclosed circuit breaker: in accordance with Section 26 28 16.02 - Moulded Case Circuit Breakers, rating as indicated.
- .3 Panelboard breaker type: in accordance with Section 26 24 16.01 - Panelboards - Breaker Type, Fusible type: in accordance with Section 26 24 16.02 – Panelboards - Switch and Fuse Type, rating as indicated.
- .4 Cabinet type 'A' for utility revenue metering Junction box Pull box Splitter box: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets, size as indicated.
- .5 Ground fault equipment: in accordance with Section 26 28 20 - Ground Fault Circuit Interrupters - Class "A".

3.0 EXECUTION**3.1 INSTALLATION**

- .1 Install service equipment.
- .2 Connect to incoming service.

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- .3 Connect to outgoing load circuits.
- .4 Install ground fault equipment.
- .5 Make grounding connections in accordance with Section 26 05 28 - Grounding – Secondary.
- .6 Make provision for power supply authority's metering.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for service entrance board.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .4 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.31, Switchgear Assemblies.

1.4 SUBMITTALS

- .1 Indicate on shop drawings.
 - .1 Floor anchoring method and foundation template.
 - .2 Dimensioned cable entry and exit locations.
 - .3 Dimensioned position and size of bus.
 - .4 Overall length, height and depth.
 - .5 Dimensioned layout of internal and front panel mounted components.
- .2 Include time-current characteristic curves for circuit breakers and fuses.

1.5 QUALITY ASSURANCE

- .1 Submit 3 copies of certified test results.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for service entrance board for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Submit 3 copies maintenance data for complete assembly including components.

2.0 PRODUCTS**2.1 SERVICE ENTRANCE BOARD**

- .1 Service Entrance Board: to CAN/CSA-C22.2 No.31.
- .2 Rating: 600 V, 3 phase, 4 wire, 800 A, short circuit current 18 kA (rms symmetrical) and/or as indicated on electrical drawings. (*Edit voltage and current rating to suit project requirement*). Cubicles: wall-mounted, or free standing, dead front, size as indicated.
- .3 Barrier metering section from adjoining sections.
- .4 Provision for installation of power supply authority metering in barriered section.
- .5 Region Representative's metering with all required CT's and PT's.
- .6 Distribution section.
- .7 Hinged access panels with captive knurled thumb screws.
- .8 Bus bars and main connections: tin plated aluminum.
- .9 Bus from load terminals of main breaker or disconnect switch via metering section to main lugs of distribution section.
- .10 Bus from load terminals of main breaker or disconnect switch to metering section and from metering section to lugs of distribution section.
- .11 Identify phases with colour coding.

2.2 MOULDED CASE CIRCUIT BREAKERS

- .1 Refer to Section 26 28 16.02 – Moulded Case Circuit Breakers.

2.3 FUSIBLE DISCONNECTS AND FUSES

- .1 Refer to Section 26 28 23 – Disconnect Switches – Fused and Non-fused.

2.4 GROUNDING

- .1 Copper ground bus extending full width of cubicles and located at bottom.
- .2 Lugs at each end for size 3/0 grounding cable.

2.5 GROUND FAULT UNIT

- .1 Refer to Section 26 28 18 – Ground Fault Equipment Protection.

2.6 POWER SUPPLY AUTHORITY METERING

- .1 Separate compartment and metal raceway for exclusive use of power supply authority metering.
- .2 Provide mounting accessories and wiring for metering as follows and as indicated:
 - .1 3 potential transformers.
 - .2 3 current transformers.
 - .3 Demand meter with kWh register as required.
- .3 Coordinate supply and installation of current and potential transformers for utility metering with utility representative. Carry all associated costs.

2.7 REGION REPRESENTATIVE'S METERING

- .1 Digital unit with capability to display:
 - .1 Phase currents
 - .2 Voltage, L-L, L-N for each phase.
 - .3 System and per-phase power including watts, vars and VA.
 - .4 System energy including watthours, varhours and VA hours.
 - .5 System demand including watt demand, VA demand and var demand.
 - .6 Apparent and displacement power factor.
 - .7 Frequency.
 - .8 Recorded minimums and maximums of most parameters.
- .2 Other features:
 - .1 Operator programmed using the face plate keypad or via communications.
 - .2 4 line x 20 character back lit LCD display.
 - .3 All monitored parameters are available at the faceplate. True rms metering of distorted currents and voltages up to the 31st harmonic.
 - .4 CSA listed under CSA C22.2 #1010.1.

- .5 KYZ pulse output to transfer demand signal to building energy management system.
- .6 Current and potential transformers as required.
- .3 Install metering units at “eye level” so that elevating devices are not required to read and use the meter.

2.8 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

- .1 Refer to Section 26 24 05 – Service Entrance TVSS Protection.

2.9 LIGHTNING ARRESTERS

- .1 Refer to Section 26 41 00.02 – Secondary Lighting Arresters.

2.10 FINISHES

- .1 Apply finishes in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .1 Service entrance board exterior: gray.

2.11 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplates:
 - .1 White plate, black letters, size 7.
 - .2 Complete board labelled: 120/208 or 347/600 V, 3 phase, 4 wire Amps as indicated.
 - .3 Main disconnect labelled: "Main Breaker or Switch".
 - .4 Branch disconnects labelled: as indicated.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Locate service entrance board and fasten to wall or floor as indicated.
- .2 Coordinate the supply and installation of current and potential transformers for utility metering with utility representative.
- .3 Connect main secondary service to line terminals of main breaker or disconnect switch.

- .4 Connect load terminals of distribution breaker's or switches to feeders.
- .5 Run one grounding conductor 3/0 AWG bare copper in 25 mm conduit from ground bus to building ground.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Check factory made connections for mechanical security and electrical continuity.
- .3 Check trip unit settings and fuse sizes against co-ordination study to ensure proper working and protection of components.
- .4 Check operation of transient voltage surge suppressor.
- .5 Check operation of Region Representative's metering.

END OF SECTION

1.0 GENERAL

1.1 REFERENCES

- .1 ANSI/IEEE C67.41, C62.45.
- .2 UL1449 - Second edition.
- .3 NFPA.
- .4 IEEE Standard 1100.
- .5 UL1283 - EMI/RRI noise attenuation standard.
- .6 NEMA LS1.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results – Electrical.
- .4 Section 26 24 02 – Service Entrance Board.
- .5 Section 26 23 00 – Low Voltage Switchgear.

1.3 SUBMITTALS

- .1 Submittal for approval: Provide the following transient protection submittals:
 - .1 Dimensional drawing of each transient voltage surge suppressor (TVSS) type, indicating proposed mounting arrangements.
 - .2 Written functional description of the transient protection circuit in terms of components, configuration, design approach, and performance capability per NEMA LS1.
 - .3 The means of connection of the TVSS to the electrical distribution system per NEMA LS1.
- .2 Provide UL-1449, Second Edition data card from manufacturer showing the Suppressed Voltage Rating (SVR) for the specific catalog number submitted. Typical UL 1449, Second Edition data is not acceptable.
- .3 Per the requirements of NEC Article 285.6, mark the devices with the short circuit current rating. Meet or exceed the available fault current. Provide test data from an independent testing laboratory to demonstrate the short circuit current rating has been tested on a complete device.

- .4 Submit test report data clearly demonstrating the maximum surge current rating has been tested on a COMPLETE TVSS unit including all necessary fusing/overcurrent protection, thermal disconnects, integral disconnects and monitoring systems.
- .5 Submit data demonstrating the TVSS unit, including all overcurrent protection, is fully capable of a minimum repetitive surge current rating of 10,000 ANSI/IEEE C62.41, Category C3 (10kA) impulses without failure or a change in performance characteristics of more than 10%.

1.4 WARRANTY

- .1 Provide manufacturer a product warranty against defects in operation and material for a period of not less than 5 years from date of Substantial Completion.

2.0 PRODUCTS

2.1 ENVIRONMENTAL

- .1 General Requirements:
 - .1 No audible noise.
 - .2 No appreciable magnetic fields. Provide proven application of use directly in computer rooms in any location without danger to disc units, disk packs, or tapes.
 - .3 Operating Conditions:
 - 1 30 B 130 Degrees F
 - 2 15 B 85 Percent Humidity Non-Condensing
 - .4 Enclosure: Heavy duty NEMA 12 dust-tight, drip-tight enclosure, as indicated.

2.2 TRANSIENT VOLTAGE SURGE SUPPRESSORS

- .1 General Requirements:
 - .1 Rated for a 347/600 volt, 60 Hertz, 3-phase, 4-wire switchboard, amperage as indicated.
- .2 Provide surge suppressors in accordance with the following requirements:
 - .1 Unit parallel in design and connected in parallel to main switchboard. Each surge suppression element (MOV) individually fused so that a failure of one element and/or fuse has no affect other surge suppression elements.
 - .2 Provide UL 1449, 2nd edition listed unit.

-
- .3 Provide maximum UL 1449 2nd Edition Suppressed Voltage Rating (SVR) for 347/600 Volt systems as follows:
 - .1 L-N = 700V
 - .2 L-G = 700V
 - .3 N-G = 700V
 - .4 L-L = 1500V
 - .4 Provide maximum surge current rating of 100,000 amperes L-N, 100,000 amperes L-G, and 100,000 amperes N-G, based on ANSI/IEEE C62.41 standard 8 by 20 microsecond current waveform. Provide a higher maximum surge current rated device if required to meet the requirements of paragraph 1.03, B., 7. above.
 - .5 Provide unit with a short circuit current rating, which equals or exceeds that of the Main Switchboard.
 - .6 Provide UL 1283 listed unit as an electromagnetic interference filter and provide 50 Ohm noise attenuation of at least 30 dB at 100 kHz, 50 dB at 1 MHz, 50 dB at 10 MHz, and 45 dB at 100 MHz.
 - .7 Include solid-state, long-life externally mounted LED visual status indicators that indicate the on-line status and operational integrity of each phase of the unit.
 - .8 Provide Form C summary alarm output contact rated for at least 1 amp at 120VAC for remote annunciation of TVSS status.
 - .9 Provide integral, non-fused disconnect system which causes no interruption to the protected load for testing and maintenance. Disconnect system shall not require removal or replacement for warranty or other repairs.
 - .10 Provide an audible alarm with an alarm on/off switch to silence the alarm and a push-to-test switch to test the alarm function.
 - .11 Provide an adjustable (resetable) counter to totalize transient voltage surges in both the normal and common mode. Provide readout with at least a seven-digit LCD located on the unit front cover and provided with a 10-year battery back-up to maintain counts in the event of power loss.
 - .12 ISO 9001 certified.

3.0 EXECUTION

3.1 GENERAL REQUIREMENTS

- .1 Install suppression system immediately next to or on top of service equipment where so approved by the Region's Representative.
- .2 Install conductors between suppressor and point of attachment to service equipment sized in accordance with manufacturer's Shop Drawings and conductor lengths as short as possible, preferably not to exceed 600 mm. Provide information from manufacturers who offer an integrated TVSS in the main service entrance equipment clearly showing lead lengths, including the neutral and ground connections.
- .3 Grounding: bond suppressor ground to the equipment grounding conductor and service entrance ground.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work results - Electrical and in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Inspect primary and secondary connections for tightness and signs of overheating.
- .3 Check fuses for correctness of type and size.
- .4 Check grounding connections.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.
- .4 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SUBMITTALS

- .1 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

2.0 PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 panelboards: bus and breakers rated minimum interrupting capacity as determined by arc flash and coordination study.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.

- .6 Tin plated aluminum bus with neutral of same ampere rating as mains.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: baked grey enamel.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

- .1 Not Used

2.3 BREAKERS

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Region's Representative.
- .5 Lock-on devices for receptacles, fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits as indicated.

2.4 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards in accordance with Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 – Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Section 26 05 00 – Common Work Results - Electrical.
- .3 Section 26 28 13.01 - Fuses - Low-Voltage.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 29, Panelboards and Enclosed Panelboards.

1.3 SUBMITTALS

- .1 Drawings to include electrical detail and dimensions of panel, branch switch type, ampacity and quantity.

2.0 PRODUCTS

2.1 PLANT ASSEMBLY

- .1 Assemble panelboard interior before shipment. Ship fuses loose for on site installation.
- .2 In addition to CSA requirements, manufacturer's nameplates must show fault current that panelboard has been built to withstand.

2.2 CONSTRUCTION FEATURES

- .1 Panelboards: product of one manufacturer.
- .2 Sequence phase bussing with odd numbered sections on left and even on right, with each section identified by permanent number identification as to circuit number and phase.
- .3 Panelboards with mains, number of circuits, and number and size of branch sections as indicated.
- .4 Two keys for each panelboard and key panelboards alike.
- .5 Tin plated aluminum bus with neutral of same ampere rating as mains.
- .6 Suitable for bolt-on fusible sections.
- .7 Trim and door finish: baked grey enamel.

- .8 Fusible pull-outs or door-operated type switches not acceptable.
- .9 Fuse clips: suitable for type of fuses specified for each unit.
- .10 Fuses: to Section 26 28 13.01 - Fuses - Low Voltage, sizes as indicated.

2.3 CUSTOM BUILT PANELBOARD ASSEMBLIES

- .1 Double stack panels as indicated.
- .2 Contactors in mains as indicated.
- .3 Feed through lugs as indicated.

2.4 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplate for each panel size 4 engraved in indicated.
- .3 Nameplate for each circuit in distribution panels size 2 engraved "name of load" as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit. Install circuit directory under plastic protective cover on front of panel.

3.0 EXECUTION

3.1 INSTALLATION GENERAL

- .1 Locate panelboards as indicated and mount securely, plumb, and square, to adjoining surfaces.
- .2 Install surface-mounted panelboards on plywood backboards. Where practical group panelboards on common backboard.
- .3 Mount panels to height specified in Section 26 05 00 – Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus.

END OF SECTION

1.0 GENERAL

1.1 RELATED WORK

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-Q9000, Quality Management and Quality Assurance Standards - Guidelines for Selection and Use.

1.3 SUBMITTALS

- .1 Submit WHMIS MSDS - Safety Data Sheets. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .2 Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.
- .3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.
- .4 Indicate:
 - .1 Outline dimensions
 - .2 Configuration of identified compartments.
 - .3 Floor anchoring method and dimensioned foundation template.
 - .4 Cable entry and exit locations.
 - .5 Dimensioned position and size of busbars and details of provision for future extension.
 - .6 Schematic and wiring diagrams.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for motor control centre for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Include data for each type and style of starter.

2.0 PRODUCTS

2.1 SUPPLY CHARACTERISTICS

- .1 600 V, 60Hz, delta connected, 3 phase, 3 wire, grounded

2.2 GENERAL DESCRIPTION

- .1 Compartmentalized vertical sections with common power busbars.
- .2 Floor mounting, free standing, enclosed dead front.
- .3 Indoor CSA, 1 gasketed enclosure, front or back to back mounting as indicated.
- .4 Class I Type A, Class I Type B, Class 1 Type C as required and indicated.

2.3 VERTICAL SECTION CONSTRUCTION

- .1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.
- .2 Each vertical section divided into compartment units, minimum 305 mm high, as indicated.
- .3 Each unit to have complete top and bottom steel plate for isolation between units.
- .4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.
- .5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.
- .6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.
- .7 Incoming cables or bus duct to enter at top or bottom with terminals as indicated.
- .8 Provision for outgoing cables to exit via top or bottom with terminals.
- .9 Removable lifting means.
- .10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.
- .11 Divide assembly for shipment to site, complete with hardware and instructions for re-assembly.

2.4 SILLS

- .1 Continuous 100 mm channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 BUSBARS

- .1 Main horizontal and branch vertical, three phase high conductivity tin plated copper busbars in separate compartment, bare, self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:
 - .1 Main horizontal busbars: 600 A or as indicated.
 - .2 Branch vertical busbars: 300 A or as indicated.
- .2 Branch vertical busbars for distribution of power to units in vertical sections.
- .3 No other cables, wires, equipment in main and branch busbar compartments.
- .4 Brace buswork to withstand effects of short-circuit current of 22 kA rms symmetrical, or as indicated.
- .5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.6 GROUND BUS

- .1 Copper ground bus extending entire width of motor control centre.
- .2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

2.7 STARTER UNIT COMPARTMENTS

- .1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.
- .2 Unit mounting:
 - .1 Engaged position - unit stabbed into vertical bus.
 - .2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.
 - .3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

- .4 Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.
- .3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.
- .4 Hinge unit doors on same side.
- .5 Overload relays manually reset from front with door closed.
- .6 Pushbuttons and indicating lights mounted on door front.
- .7 Devices and components by one manufacturer to facilitate maintenance.
- .8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

2.8 WIRING IDENTIFICATION

- .1 Provide wiring identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

2.9 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
 - .1 Motor control centre main nameplate: size No. 7, engraved as indicated.
 - .2 Individual compartment nameplates: size No. 5, engraved as indicated.

2.10 FINISHES

- .1 Apply finishes in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Paint motor control centre exterior light gray and interiors white.

2.11 SOURCE QUALITY CONTROL

- .1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.
- .2 Provide Region's Representative with certified copy of standard factory tests of complete motor control centre including operation of switches, circuit breakers, starters and controls.
- .3 Manufacturer to provide proof of quality control program in accordance with CAN/CSA-Q9000.

3.0 EXECUTION**3.1 INSTALLATION**

- .1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.
- .2 Make field power and control connections as indicated.
- .3 Ensure correct overload heater elements are installed.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Ensure moving and working parts are lubricated where required.
- .3 Operate starters in sequence to prove satisfactory performance of motor control centre every hour for an 8 hour period.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 26 05 00 – Common Work Results – Electrical.

1.2 SUBMITTALS

- .1 Indicate:
 - .1 Complete assembly.
 - .2 Contact surfaces.
 - .3 Construction features.
 - .4 Wiring diagrams.
 - .5 Catalogue information.
- .2 Submit one of each as requested.

1.3 DELIVERY

- .1 Deliver to designated fixture or equipment manufacturer required quantity of interceptors, receptacles and/or plugs for installation and connection to fixture or equipment.

2.0 PRODUCTS

2.1 COMPONENTS

- .1 Designed for up to and including 600 V, 20 A lighting and branch wiring installations.
- .2 Integrally moulded thermoplastic, colour coded black for normal and red for emergency circuits. Special colour for system identification ie. blue, grey, yellow, white.
- .3 Certified to make or break under full rated load.

2.2 CABLE SETS

- .1 Two to nine conductor - No.12 stranded ultralx armoured cable c/w integrally moulded male and/or female caps.

- .2 Factory assembled and integrally moulded.
- .3 Four meter minimum lengths. Allow 2 m extra cable for relocation of fixtures and equipment where required.
- .4 Starter cables: complete with one end prepared for field installation and other end complete with moulded female cap. Field prepared end: armour removed 150 mm and complete with locknutless connector and suitable for circuit connection to standard outlet box.
- .5 Joiner cables: one end c/w integrally moulded male cap and other end c/w female cap.
- .6 Switch drop cables: c/w one end prepared for field installation and other end c/w integrally moulded switch cap. Field prepared end: armour removed 150 mm and c/w locknutless connector suitable for circuit connection to standard outlet box or equipment.
- .7 Feed drop cables: c/w one end prepared for field installation and other end c/w integrally moulded switch cap. Field prepared end: armour removed 150 mm and c/w locknutless connector suitable for circuit connection to standard outlet box or equipment

2.3 INTERCEPTORS AND RECEPTACLES

- .1 Designed for flush mounting in fixtures or equipment to afford low profile connection with cable sets.
- .2 Slip-lock fit design for securing interceptor to fixtures or equipment.

2.4 SWITCH KITS

- .1 Switch kits are designed for circuit switching and include switch adaptor, crossover cable and switching cable. Switch adaptor provides power-in recessed plug, power-out receptacle, switch drop cable receptacle, and switched power-out receptacle. Switch kits: approved as portable equipment and capable of connection or disconnection under full rated load.

2.5 MULTI-TAP ADAPTORS

- .1 Designed for circuit splitting. Multi-tap adaptor provides power-in recessed plug and three power-out receptacles.

2.6 PHASE-TAP ADAPTORS

- .1 Designed for splitting of 3 phase power supply into 3 single phase power receptacles. Phase-tap adaptor provides power-in recessed plug and 3 power-out receptacles. First power-out receptacle is connected and identified as phase "A"; second power-out is connected and identified as phase "B"; and third power-out

receptacle is connected and identified as phase "C". All three power-out receptacles allow connection of single phase power drop cable.

2.7 BLANKING PLUGS

- .1 Designed to blank off unconnected receptacles in interceptors, switch adaptors, and tap adaptors.

2.8 WALL ASSEMBLIES

- .1 Wall assemblies are completely pre-wired in gangs of 1, 2, 4 or 6 as shown on drawings.
- .2 Connected with 105 degree Ultralx cables prepared with locknut less connectors and molded plugs. Ready for connection to ceiling or under floor distribution boxes with matching receptacles.
- .3 Wall assemblies have adjustable wall supports for 12.5 mm or 15.5 mm drywall. Supports have fastening holes for mounting to studs or level for block walls.
- .4 Factory installed receptacles, barriers and cover plates (one per gang).
- .5 Factory installed Ultralx flexible-type raceway with internal throat connectors for telephone, data, communications etc.
- .6 Snap-in style finishing plates and rings for the overlapping to drywall, block etc.

2.9 BRANCH FEEDERS

- .1 Ultralx 105 feeders for connection from the electrical panel to ceiling, wall or underfloor outlet/distribution assemblies as indicated on drawings. Feeder Starters (US) are prepared with one 60 inches for connection to panel and other end for connection to distribution assembly. Branch Feeders (UT) have both ends prepared for connection between distribution assemblies.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install system and components in accordance with manufacturer's instructions.
- .2 Install and connect branch feeders from electrical panel to the circuit ceiling outlet/distribution assemblies as indicated.
- .3 Install starter cables to circuit outlet boxes and connect to power circuit and energize.
- .4 Install multi-tap adaptors and phase-tap adaptors for circuit switching and splitting as required.

-
- .5 Install joiner cables between interceptors in fixtures or equipment. Allow extra cable to facilitate removal and relocation of fixtures or equipment.
 - .6 Install blanking plugs in unconnected receptacles.
 - .7 Install wall assemblies as shown on drawings and connect to designated circuits.
 - .8 Integrally moulded thermoplastic components to match colour identification system (ie. black for normal power, red for emergency power).
 - .9 Install receptacle circuit and phasing identification as required.
 - .10 On completion of the installation, the manufacturer representative shall be notified to carry out a site inspection and report any inconsistencies to the Region's Representative. Corrections are to be implemented to comply with manufacturer's report.
 - .11 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 26 27 26 - Wiring Devices.

1.2 SUBMITTALS

- .1 Indicate type of multi-outlet assemblies with similar terminology to these documents.

2.0 PRODUCTS

2.1 SURFACE RACEWAY FOR WIRING DEVICES

- .1 Two piece assembly manufactured for mounting wiring devices and associated wiring.
- .2 Cross-section dimensions: as indicated.
- .3 Finish: buff enamel.

2.2 WIRING DEVICES

- .1 Wiring devices: as indicated, to Section 26 27 26 - Wiring Devices.

2.3 PREWIRED RECEPTACLE HARNESS

- .1 Receptacle harness factory assembled with duplex receptacles at 1525 mm centres on 1 circuit.

2.4 GROUNDING

- .1 Ground system through separate insulated conductor.

2.5 VINYL PLASTIC STRIP

- .1 Extruded rigid vinyl plastic with 2- No.12 AWG copper wires and continuous ground strip.
- .2 Unfused "U" ground lock-in receptacle for each 1.5 m of strip as indicated.

2.6 FITTINGS

- .1 Elbows, tees, couplings, hanger fittings and other fittings providing directional or dimensional changes manufactured as accessories to product line supplied.

3.0 EXECUTION**3.1 FITTINGS**

- .1 Install supports, elbows, tees, connectors, fittings.
- .2 Keep number of elbows, offsets and connections to minimum.
- .3 Install barriers where required.

3.2 WIRING

- .1 Install wiring as indicated Install receptacle harness.

3.3 VINYL STRIP RECEPTACLES

- .1 Install receptacles.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Indoor aluminum service poles and installation.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM B31, Standard Specification for Aluminum-Alloy Extruded Bar, Rod, Tube, Pipe, and Structural Profiles for Electrical Purposes (Bus Conductor).

2.0 PRODUCTS

2.1 INDOOR SERVICE POLES

- .1 Indoor service pole assembly to meet telephone company requirements.
- .2 Indoor service poles: extruded aluminum sections to ASTM, beige color anodized finish of 10 micrometers thickness.
- .3 Nominal length of poles: 2.8 m from floor to ceiling, with plus or minus 50 mm adjustment. Total adjustment: 100 mm.
- .4 Service poles approximately 50 mm square with snap-on covers to provide access to wiring without removing unit. Barrier to isolate power from communication systems.
- .5 Service poles with fastening accessories at top of pole to secure to inverted T-Bar ceiling using set screws to permit relocation. Flange at ceiling to conceal wiring.
- .6 Metal sleeve at bottom of pole to conceal vertical adjustment. Reversible grip-tight devices for carpet and tile floors to prevent movement of poles.
- .7 Service poles with two prewired duplex receptacles, two knockout holes for telephone Amphenol and one for communication. Cord with molded set extending 3 m from top of pole.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install service poles as indicated.
- .2 Install service poles in accordance with manufacturer's recommendations. Secure to ceiling and to finished floor. Adjust length as required. Connect cord to receptacle installed in ceiling space.
- .3 Re-adjust service poles as required after telephone cables are installed.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 –General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

2.0 PRODUCTS

2.1 SWITCHES

- .1 Not Used.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Ivory thermoplastic moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.

- .6 Specification grade.
- .7 Hospital grade as indicated.
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout project.

2.3 SPECIAL WIRING DEVICES

- .1 Not Used.

2.4 WIRING DEVICES FOR COMPUTER ROOMS

- .1 As indicated.

2.5 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Nylon ivory or stainless steel cover plates as indicated, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.
- .5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.
- .8 All wiring device cover plates to be labeled using clear adhesive strips with black type identifying panel and circuit number for each device.

3.0 EXECUTION

3.1 INSTALLATION

.1 Switches:

- .1** Install single throw switches with handle in "UP" position when switch closed.
- .2** Install switches in gang type outlet box when more than one switch is required in one location.
- .3** Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Receptacles:

- .1** Install receptacles in gang type outlet box when more than one receptacle is required in one location.
- .2** Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .3** Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Cover plates:

- .1** Protect cover plate finish with paper or plastic film until painting and other work is finished.
- .2** Install suitable common cover plates where wiring devices are grouped.
- .3** Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 78 00 – Closeout Submittals.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2No.248.12, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 SUBMITTALS

- .1 Submit fuse performance data characteristics for each fuse type and size above 600 A. Performance data to include: average melting time-current characteristics.

1.4 DELIVERY AND STORAGE

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in storage cabinet moisture free location.

2.0 PRODUCTS

2.1 FUSES GENERAL

- .1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer for entire project.

2.2 FUSE TYPES

- .1 Class L fuses (formerly HRC-L).
 - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type L2, fast acting.

- .2 Class J fuses (formerly HRCI- J).
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type J2, fast acting.
- .3 Class R -R fuses (formerly HRCI- R). For UL Class RK1 fuses, peak let-through current and its' peak let-through values not to exceed limits of UL 198E-1982, table 10.2.
 - .1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
 - .2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.
- .4 Class -C fuses (formerly HRCII- C).

2.3 FUSE STORAGE CABINET

- .1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00 – Common Work Results - Electrical.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit. Ensure correct fuses fitted to physically match mounting devices.
 - .1 Install Class R rejection clips for HRCI-R fuses.
- .2 Ensure correct fuses fitted to assigned electrical circuit.
- .3 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.
- .4 Install spare fuses in fuse storage cabinet.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for outdoor load break switches and fuses.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C37.46, Specifications for High Voltage Explosion and Current-Limiting Type Power Class Fuses and Fuse Disconnecting Switches.
- .2 Electrical and Electronic Manufacturers Association of Canada (EEMAC)
 - .1 EEMACG1-1, Indoor and Outdoor Switch and Bus Insulators.
- .3 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA SG2, High-Voltage Fuses.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Indicate:
 - .1 Load break mechanism.
 - .2 Switching type.
 - .3 Mounting design.
 - .4 Fuse holder mechanism.
 - .5 Gang operating mechanism.
 - .6 Load rating.

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Include: as recommended by manufacturer.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Fuses: to NEMA SG2 and ANSI C37.46.
- .2 Insulators: to EEMAC G1-1, as indicated.

2.2 LIGHT LOAD AIR BREAK SWITCHES

- .1 Horizontal mounted, vertical break, rotating insulator, gang operated, single throw, 3 pole.
- .2 Rating: 600A, 5, 15 kV, as indicated.
 - .1 Momentary rms asymmetrical A: 18,000 or as indicated.
- .3 Insulators: post type.
- .4 Universal mounting base for each pole designed for wood mounting, as indicated.
- .5 Arc horns: galvanized steel to permit switch opening and closing under light load, magnetizing or charging currents.
- .6 Bearings: silicone grease lubricated for life.
- .7 Interphase mechanism assembly:
 - .1 Operated from center end.
 - .2 Outside poles connected to center pole through end yoke assemblies, pipe turnbuckles and universal ball and yoke assembly to permit switch operation with up to 15 degrees misalignment of pole bases.
 - .3 Bearings and moving joints on each pole and interphase mechanism positively sealed by silicone cord rings.
- .8 Manual operating mechanism with:
 - .1 One offset bearing.
 - .2 Pipe shaft: length as indicated.
 - .3 Pipe guides.
 - .4 Pipe couplings.
 - .5 Position indicator.

- .6 Foot bearing.
- .7 Operating handle with padlock.

2.3 FULL LOAD AIR BREAK SWITCHES

- .1 Horizontal, vertical or inverted mounted, as indicated, vertical break, gang operated, single throw, 3 pole, as indicated.
- .2 Rating: 600 A, 5, 15 kV, as indicated.
 - .1 Momentary rms asymmetrical A: 18,000 or as indicated.
- .3 Insulators: three per pole, standard station post type.
- .4 Contacts:
 - .1 Silver-nickel alloy spring loaded multi-contact switch blade contacts.
- .5 Interrupter unit to permit opening and closing under rated full load currents consists of:
 - .1 Mechanism actuated by levers for operating contacts.
 - .2 Bolted to fixed contact assembly of switch.
 - .3 Shunt contact bolted to switch blade actuates interrupter unit when blade is moved to open or closed position.
- .6 Switch base: 5 mm formed channel galvanized steel drilled for universal mounting on wood pole.
- .7 Interphase mechanism assembly.
 - .1 Operated from center pole.
 - .2 Poles interconnected by articulated pipe assembly to allow for minor misalignment.
- .8 Manual operating mechanism with:
 - .1 Two offset bearings.
 - .2 Pipe shaft: length as indicated.
 - .3 Pipe guides.
 - .4 Pipe couplings.
 - .5 Position indicator.
 - .6 Foot bearing.

- .7 Operating handle with padlock.

2.4 PRIMARY FUSES

- .1 Disconnect vertical, 180 degrees opening type.
- .2 Voltage rating: as indicated.
- .3 Continuous current rating: 200, 300, 400 or 720 A, or as indicated.
- .4 Three phase symmetrical short circuit ratings:
 - .1 150 MVA at 4.16 kV.
 - .2 400 MVA at 13.8 kV.
- .5 Refill unit consisting of:
 - .1 Fusible element: silver.
 - .2 Arcing rods: main rod copper, silver clad, auxilliary rod stainless steel.
 - .3 Solid material arc-extinguishing medium contained in filament wound glass-epoxy tube.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Connect switch terminals to primary feeder and load feeder.
- .3 Locate, mount and connect fuses.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Energize and load feeders controlled by load break switches.
- .3 Open and close load break switches at least ten times over period of 8 hours to ensure proper mechanical and electrical performance of installation.

END OF SECTION

1.0 GENERAL**1.1 SECTION INCLUDES**

- .1 Materials and installation for air circuit breakers.
- .2 Text to complete Section 26 23 00 - Low Voltage Switchgear.
- .3 Text to complete Section 26 28 18 - Ground Fault Equipment Protection.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results - Electrical

1.3 REFERENCES

- .1 American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE C37.13, Low Voltage AC Power Circuit Breakers Used in Enclosures.
- .2 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

- .1 Include time-current phase protection co-ordination characteristic curves for breakers.

2.0 PRODUCTS**2.1 AIR CIRCUIT BREAKER**

- .1 Air circuit breaker to: to ANSI/IEEE C37.13 and CSA C22.2 No.5.
- .2 Drawout type, 600 V class.
 - .1 Continuous current rating: as indicated.
 - .2 Trip rating: as indicated.
 - .3 Interrupting rating: as indicated kA, rms symmetrical.

- .3 Solid-state tripping system consisting of 1 current sensor per pole, 1 solid-state trip unit and self-powered trip actuator. Equipped with long, short, instantaneous, ground fault function and phase overload and ground fault indication.
- .4 Breakers with normal stored energy, closing mechanism to provide quick-make operation for all ratings.
- .5 Breakers with motor charged, stored energy, quick-make, closing mechanism with emergency manual spring charging handle and isolating switch to isolate power supply to spring charging motor.
- .6 Breakers with on-off indicator and spring charged/discharged indicator.
- .7 Interlocks to prevent circuit breaker drawout when in closed position and to prevent closing unless fully engaged or in test position.
- .8 Current limiting fuses in series and internally mounted up to 2000 A frame size. Provide in parallel to current limiting fuses, anti-single-phasing coils which act on tripper bar to prevent single phasing. Coordinate time current limiting characteristics of fuses with time current tripping characteristics of circuit breaker.

2.2 OPTIONAL FEATURES

- .1 Shunt trip.
- .2 Auxiliary switches: 2 N.O., 2 N.C.
- .3 Undervoltage tripping device with instantaneous trip.
- .4 Alarm switch.
- .5 Pilot light.
- .6 Reverse power relay.
- .7 Control relay
- .8 Key interlock.
- .9 Remote close.
- .10 Lockout devices.
- .11 Padlocking provision.
- .12 Operation counter.

3.0 EXECUTION**3.1 INSTALLATION**

- .1 Install air circuit breakers as indicated.
- .2 Connect main secondary service to line terminals of breaker.
- .3 Connect load terminals of breaker to feeders.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Check factory made connections for mechanical security and electrical continuity.
- .3 Check trip unit settings and y to ensure proper working operation and protection of components.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results – Electrical.

1.2 SUBMITTALS

- .1 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

2.0 PRODUCTS

2.1 BREAKERS GENERAL

- .1 Bolt-on molded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

- .1 Molded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 FUSED THERMAL MAGNETIC BREAKERS DESIGN B

- .1 Fused thermal magnetic breakers with current limiting fuses internally mounted. Time current limiting characteristics of fuses coordinated with time current tripping characteristics of circuit breaker. Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker. Fuses individually removable and interlocked with breaker. Removal of fuse cover, blowing of a fuse or removal of a fuse, to trip breaker.

2.4 SOLID STATE TRIP BREAKERS DESIGN C

- .1 Molded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time short time, instantaneous tripping for phase and ground fault short circuit protection.

2.5 OPTIONAL FEATURES

- .1 Include:
 - .1 shunt trip.
 - .2 auxiliary switch.
 - .3 motor-operated mechanism c/w time delay unit.
 - .4 under-voltage release.
 - .5 on-off locking device.
 - .6 handle mechanism.

2.6 ENCLOSURE

- .1 Mounted in NEMA 1 type enclosure, sprinkler proof as indicated.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Equipment, fabrication and installation for ground fault protection.
- .2 Text to complete Section 26 23 00 - Low Voltage Switchgear.
- .3 Text to complete Section 26 24 02 - Service Entrance Board.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.3 PAYMENT PROCEDURES

- .1 Pay for field testing of ground fault equipment performed by equipment manufacturer.

1.4 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No. 144, Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.

1.5 SUBMITTALS

- .1 Submit product data and shop drawings.
- .2 Submit test report for field testing of ground fault equipment to Region's Representative and a certificate that system as installed meets criteria specified.

2.0 PRODUCTS

2.1 EQUIPMENT

- .1 Ground fault protective equipment: components of one manufacturer.

-
- .2 Provide ground fault protection on 1000A, 600V, 4 wire, 3 phase service and 2000 A, 208V, 4 wire, 3 phase service and above: to NEMA PG 2.2 and CAN/CSA-C22.2 No. 144.
 - .3 Ground fault unit to contain:
 - .1 Ground sensing relay suitable for operation at 500 mA as indicated on electrical drawings. Control voltage: 120 V.
 - .2 Ammeter with scale 0 to 5 A to indicate ground current value.
 - .3 Three position sensitivity control switch to select value of leakage current at which relay will operate.
 - .4 Indicating lamp illuminated when no ground fault exists, extinguished on ground fault or test.
 - .5 Switch:
 - .1 SPDT contacts for alarm and trip.
 - .2 Mechanical target indication.
 - .3 Manually reset.
 - .6 Reset button for contacts and target.
 - .7 Suitable for panel mounting.
 - .4 Zero sequence transformer toroidal type with 300 - 3000 mA range.
 - .5 Neutral:
 - .1 Use an artificial neutral and grounding resistor.
 - .2 Use neutral ground resistor unit.
 - .6 System to operate instantaneously at ground current setting.

2.2 FABRICATION

- .1 Install following components in equipment specified in other Sections and as indicated.
 - .1 Zero sequence transformer.
 - .2 Ground fault relay.
 - .3 Ground resistor unit.

2.3 RELATED EQUIPMENT

- .1 Shunt trip breakers. Load break disconnect switch.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Do not ground neutral on load side of sensor.
- .2 Install phase conductors including neutral through zero sequence transformer.
- .3 Install ground fault protection system.
- .4 Make connections as indicated and in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Arrange and pay for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.
- .3 Check trip unit settings to ensure proper working operation and protection of components.
- .4 Demonstrate simulated ground fault tests.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Equipment and installation for ground fault circuit interrupters (GFCI).

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 43 00 - Quality Assurance.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .4 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.144, Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.

1.4 SUBMITTALS

- .1 Submit product data and shop drawings.
- .2 Submit test report for field testing of ground fault equipment to Region’s Representative and a certificate that system as installed meets criteria specified herein.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144.
- .2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

- .1 Single or two pole ground fault circuit interrupter for 15-20 A, 120 V, 1 phase circuit c/w test and reset facilities.

2.3 GROUND FAULT LIFE PROTECTOR

- .1 A, 2 pole circuit breaker to supply power to mains of 100A, 208 V, 3 phase panel and complete with:
 - .1 Automatic shunt trip breaker.
 - .2 Zero sequence current sensor.
 - .3 Facilities for testing and reset.
 - .4 CSA Enclosure 1, surface mounted.
 - .5 Ground fault trip indicator light.

2.4 GROUND FAULT PROTECTOR UNIT

- .1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:
 - .1 Solid state ground sensing device.
 - .2 Facility for testing and reset.
 - .3 CSA Enclosure 1, flush mounted with stainless steel face plate.

2.5 SYSTEM GROUND FAULT PROTECTION PANEL

- .1 Self-contained panel suitable for 120/208 V, 3 phase, 4 wire, grounded supply. Panel to have following features:
 - .1 Automatic 100 or 225 A breaker with shunt trip.
 - .2 Ground fault relay factory set at 10 mA with inverse time delay characteristics from pick-up 1 s to 0.025 s.
 - .3 Zero sequence current sensor.
 - .4 Provision for testing and reset.
 - .5 CSA Enclosure 1, surface mounted.
 - .6 Ground fault trip indicating light.
 - .7 Resistor type fused artificial neutral.

2.6 PUMP PROTECTION PANEL

- .1 Ground fault personnel protection panel for pump circuits rated for 20 hp at 208 V and 50 hp at 600 V, 3 phase grounded supply with following features:

-
- .1 Test button, ground indicator light, reset button.
 - .2 Line and load terminal blocks and control terminal block for wiring to starter control.
 - .3 Unit sensitivity: 10 mA.
 - .4 CSA Enclosure 1, surface mounted.
 - .5 Contact rating: 5 A, 120 V, 60 Hz.
 - .6 Fused resistive type artificial neutral.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Do not ground neutral on load side of ground fault relay.
- .2 Pass phase conductors including neutral through zero sequence transformers.
- .3 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Arrange and pay for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.
- .3 Demonstrate simulated ground fault tests.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

2.0 PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible, disconnect switch in CSA Enclosure type 1, size as indicated.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated, to Section 26 28 13.01 - Fuses - Low Voltage.
- .5 Fuse holders: suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses as indicated.

END OF SECTION

1.0 GENERAL**1.1 SECTION INCLUDES**

- .1 Materials and installation for contactors for system voltages up to 600 V

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.
- .4 Section 26 29 03 - Control Devices.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.14, Industrial Control Equipment.

2.0 PRODUCTS**2.1 CONTACTORS**

- .1 Contactors: to CSA C22.2 No.14.
- .2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
- .3 Fused switch combination contactor as indicated.
- .4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .5 Mount in CSA Enclosure 1 unless otherwise indicated.
- .6 Include following options in cover:
 - .1 Red indicating lamp.
 - .2 Hand-Off-Auto selector switch.
- .7 Control transformer: in accordance with Section 26 29 03 - Control Devices, in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

- .2 Size 4 nameplate indicating name of load controlled as indicated.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install contactors and connect auxiliary control devices.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for industrial control devices including pushbutton stations, control and relay panels.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.14, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SUBMITTALS

- .1 Include schematic, wiring, interconnection diagrams.

1.5 QUALITY ASSURANCE

- .1 Submit to Region's Representative one copy of test results.

2.0 PRODUCTS

2.1 AC CONTROL RELAYS

- .1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.
- .2 Convertible contact type: contacts field convertible from NO to NC, electrically held, with solid state timer as indicated. Coil rating: as indicated. Contact rating: as indicated.
- .3 Sealed contact type: electrically held. Coil rating: as indicated. Contact rating: as indicated.
- .4 Universal pole type: electrically held convertible from NO to NC by changing wiring connections. Coil rating: as indicated. Contact rating: as indicated.
- .5 Fixed contact plug-in type: general purpose low coil current. Coil rating: as indicated. Contact rating: as indicated.

- .6 Socket bases and DIN mounting rails for plug-in type relays.

2.2 RELAY ACCESSORIES

- .1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 SEALED CONTACT OILTIGHT LIMIT SWITCHES

- .1 Lever type switches: roller fork or rod operated, single or double pole, double throw. Contact rating: as indicated.
- .2 Push type switches: actuated by rod or plunger located on side of operating head, spring return single pole, throw. Contact rating: as indicated.
- .3 Wobble stick cat whisker type switches: actuated by rod or stick extending from tip of operating head. Moving rod in any direction operates contacts. Single pole, double throw. Contact rating: as indicated.
- .4 Lever operated: time delay switch: adjustable time delay from 1/2s to 15s plus 25%. Contact rating: as indicated.
- .5 Plug-in construction switches: CSA Type 4, two or four circuit, lever push or wobble stick type, contact rating: as indicated.

2.4 SOLID STATE TIMING RELAYS

- .1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact. Timing circuit and output contact completely encapsulated to protect against vibration, humidity and atmospheric contaminants.
- .2 Operation: on-delay or off-delay.
- .3 Potentiometer: self contained to provide time interval adjustment.
- .4 Supply voltage: 120 or 24 V, AC, 60 Hz, as indicated.
- .5 Temperature range: minus 20 degrees C to 60 degrees C.
- .6 Output contact rating: maximum voltage 300 V AC or DC. Current: NEMA ICS 1 as indicated.
- .7 Timing ranges: minimum 0.5 maximum 60s.

2.5 INSTANTANEOUS TRIP CURRENT RELAYS

- .1 Enclosure: CSA Type 1.
- .2 Contacts: NO, NC automatic reset with adjustable tripping point.

- .3 Control: 3 wire, with provision for shorting contacts during accelerating period of motor.

- .4 Contact rating: NEMA ICS 1 as indicated.

2.6 OPERATOR CONTROL STATIONS

- .1 Enclosure: CSA Type1, surface mounting:

2.7 SELECTOR SWITCHES

- .1 Maintained 2 or 3 position labelled as indicated standard duty, operators wing lever, contact arrangement as indicated, rated as indicated.

2.8 INDICATING LIGHTS

- .1 Standard duty, full voltage, transformer LED type, push-to-test, lens colour: as indicated, supply voltage as indicated, labels as indicated.

2.9 CONTROL AND RELAY PANELS

- .1 CSA Type 1 sheet steel enclosure (sprinkler proof where required) with hinged padlock able access door, accommodating relays, timers, labels, as indicated, factory installed and wired to identified terminals.

2.10 CONTROL CIRCUIT TRANSFORMERS

- .1 Single phase, dry type.
- .2 Primary: 208, 240 or 600 V, 60 Hz ac.
- .3 Secondary: 120 V, or 24V ac.
- .4 Rating: 50, 150, 250, 350 or 500 VA, as indicated.
- .5 Secondary fuse: size as required.
- .6 Close voltage regulation as required by magnet coils and solenoid valves.

2.11 THERMOSTAT (LINE VOLTAGE)

- .1 Wall mounted, for exhaust fan control.
- .2 Full load rating: Amps as indicated at 120 V.
- .3 Temperature setting range: 10 degrees C to 30 degrees C.
- .4 Thermometer Range: 10 degrees C to 30 degrees C.

- .5 Markings in 5 degrees increments.
- .6 Differential temperature fixed at 20 degrees C.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install pushbutton stations, control and relay panels, control devices and interconnect as required on control wiring diagrams as per drawings.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.
- .3 Upon completion of sectional test, undertake group testing.
- .4 Check out complete system for operational sequencing.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .4 Section 26 05 00 – Common Work Results - Electrical.

1.2 DESCRIPTION OF SYSTEM

- .1 System to consist of:
 - .1 Rectifier
 - .2 Invertor
 - .3 Battery
 - .4 Bypass switch cubicle
 - .5 Microprocessor controlled logic and control panel.
 - .6 Input and output filters.
 - .7 Chopper
 - .8 Load side isolation transformer
- .2 System to use normal power supply mains and battery to provide continuous, regulated ac power to isolated load.
- .3 Equipment to operate continuously and unattended.
- .4 Ensure that UPS is compatible with equipment that it feeds.

1.3 SUBMITTALS

- .1 Include:
 - .1 Outline sketch showing arrangement of cubicles, meters, controls, recommended aisle spaces, battery rack, battery arrangement and dimensions.
 - .2 Shipping weight

-
- .3 Schematic diagram showing interconnection of rectifier, inverter, battery, bypass switch, meters, controls and indicating lamps.
 - .4 Description of system operation, referenced to schematic diagram, for:
 - .1 Manual control during initial start-up and load transfer to bypass and back to inverter output.
 - .2 Inverter
 - .3 Bypass
 - .5 System performance and reliability:
 - .1 Consider any deviation from the required output power waveform as a failure in the UPS and include an estimate, with supporting calculations, of the Mean Time Between Failures (MTBF) expressed in hours.
 - .2 Provide an estimate with supporting data for the Mean Time to Repair factor (MTTR).
 - .6 Full load kVA output at unity power factor.
 - .7 Efficiency of system at 25%, 50%, 75% and 100% rated load.
 - .8 Type of ventilation: natural or forced.
 - .9 Battery:
 - .1 Number of cells
 - .2 Maximum and minimum voltages
 - .3 Type of battery
 - .4 Type of plates
 - .5 Catalogue data with cell trade name and type
 - .6 Size and weight of each cell
 - .7 Derating factor for specified temperature range.
 - .8 Nominal ampere hour capacity of each cell.
 - .9 Maximum short circuit current

- .10 Maximum charging current expected for fully discharged condition.
- .11 Recommended low voltage limit for fully discharged condition.
- .12 Expected life.
- .10 Inverter:
 - .1 Type and catalogue number.
 - .2 dc current at minimum battery voltage to produce full load ac output.
- .11 Rectifier:
 - .1 Type and capacity, with catalogue number
 - .2 Battery charging sequence
 - .3 Guaranteed noise level.
 - .4 Estimated life.
 - .5 Metering
 - .6 Alarms
- .12 Heat losses at no load, 25%, 50%, 75% and 100% of rated output, in kW.
- .13 Cooling air required in m³/s.
- .14 Spare parts, tools and instruments to perform system maintenance.

1.4 SOURCE QUALITY CONTROL

- .1 Provide manufacturer's field experience with uninterruptible power systems of similar ratings including engineering expertise manufacturing facilities and listing of UPS units manufactured and installed during the last 5 years including model, customer, location and installation dates.

1.5 OPERATION AND MAINTENANCE DATA

- .1 Provide data for incorporation into operation and maintenance manual specified in Section 01 78 00 – Closeout Submittals.
- .2 Submit final O&M manual. Final manual approved by Region's Representative. Submit copies to Region's Representative prior to notification of test dates.

- .3 Operation and Maintenance Manual to include:
 - .1 Operation and maintenance instructions concerning design elements, construction features, component functions and maintenance requirements to permit effective operations maintenance and repair.
 - .2 Technical data:
 - .1 Approved shop drawings 420 x 590 mm in size.
 - .2 Characteristic curves for automatic circuit breakers and protective devices.
 - .3 Project data
 - .4 Technical description of components.
 - .5 Parts lists with names and addresses of suppliers.

1.6 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Include:
 - .1 Four sets of each type and size of fuses used.
 - .2 Four sets indicating lamps.

1.7 DELIVERY AND STORAGE

- .1 Crating:
 - .1 Adequately enclosed and protected from weather and shipping damage by use of minimum 12 mm plywood with vapour barrier inside.
 - .2 For tractor train or sea shipment use double layer of vapour barrier and 19 mm plywood covering.
 - .3 Subassemblies may be packed separately.
 - .4 Label crates:
 - .1 Shipping address.
 - .2 Weight and dimensions
 - .3 Serial number of unit and brief description of contents.

.4 Stenciled with durable paint on at least two sides of each crate.

.5 List of contents:

.1 In weatherproof envelope stapled on outside of each crate.

.2 Copy placed inside each crate.

1.8 SERVICEABILITY

.1 Successful bidder shall be required to have a permanent local authorized service representative for UPS systems on the island portion of the province.

1.9 WARRANTY

.1 Provide full 3-year, on-site product warranty from manufacturer guaranteeing the UPS system and battery against defects in operation, material and workmanship from date of Substantial Completion. Include parts and labour with warranty.

1.10 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by system manufacturer to train designated personnel in the use and maintenance of the system.

2.0 PRODUCTS

2.1 SYSTEM PERFORMANCE

.1 Normal operation:

.1 System operates on mains power when mains voltage is within +10% and -30% of nominal value and mains frequency is between 45 and 65 Hz.

.2 Battery operation:

.1 System transfers automatically to battery operation.

.1 When manually selected at control panel.

.2 When mains power fails.

.3 When mains voltage varies more than +10% and -25% from nominal or mains frequency varies more than 5 Hz from 60 Hz.

.4 When mains power is restored system automatically resynchronizes with mains.

- .5 Slew rate of frequency during transition period of system output automatically synchronizing with mains and return to its internal frequency.
- .3 Bypass operation:
 - .1 For maintenance purposes, system can be bypassed automatically by manual selection at control panel to connect load directly to ac mains. Transfer without load interruption and leaving inverter energized.
 - .2 Load transfer from mains back to system automatically by manual selection at control panel when maintenance completed.
 - .3 Automatic transfer of load to mains in not more than 1/4 cycle including sensing with inverter left energized but disconnected from load in case of:
 - .1 Inverter overloaded.
 - .2 Short circuit in load.
 - .4 Automatic retransfer of load to system without load interruption when above conditions disappear.
 - .5 Automatic transfer of load to mains in not more than 1/4 cycle including sensing and shutdown of inverter in case of inverter internal malfunctions.
 - .6 Automatic transfer of load to mains without load interruption and inverter shutdown in case of:
 - .1 Overttemperature harmful to system.
 - .2 Loss of forced ventilation.
 - .3 Low voltage of dc supply to inverter.
 - .7 Bypass capable of closing onto and withstanding momentary fault current of 800% of rating for 0.01 s.

2.2 SYSTEM PROTECTION

- .1 Automatic circuit breakers and protection included in:
 - .1 AC input to rectifier
 - .2 Battery input
 - .3 Bypass circuit input
 - .4 Inverter output

- .2 Power conditioning by M.O.V.'s, line filters and isolation transformer:
 - .1 To protect system against supply voltage switching transients.
 - .2 To protect internal circuits where necessary against voltage transients.
- .3 Failure of circuit or component not to cause equipment to operate in dangerous or uncontrolled mode.

2.3 ENCLOSURE

- .1 Dead front free standing sheet steel minimum 2.5 mm thick, CSA Enclosure 1.
- .2 Access preferably from front and rear.
- .3 Meters, indicating lamps and controls group mounted in panel front.
- .4 Panel front enclosed by hinged doors to prevent tampering and to protect instruments and controls during shipping.
- .5 Leveling feet.
- .6 Ambient temperature range during operation 0EC to +40EC. Natural or forced ventilation as required. For forced ventilation power from inverter output and fan directly driven by single phase motor mounted on vibration isolators. Each enclosure to have redundant fans, with fan failures alarmed. Air inlet and outlet openings protected with screens and metal guards.
- .7 Disposable air filters on fan cooled enclosures. Method of attachment and opening locations to make removal convenient and safe.
- .8 Maximum operating sound level not to exceed 45 db(A) as measured on sound level meter with A weighing and slow response, at 1.0 m.

2.4 OPERATING DEVICES

- .1 Panel:
 - .1 Panel for complete monitoring control of UPS:
 - .1 Operation panel features:
 - .1 Run/Stop key switch
 - .2 Emergency Power Off pushbutton
 - .3 AC input voltage indicator
 - .4 Battery status indicator

- .5 Invertor indicator
 - .6 Bypass indicator
 - .7 Fault indicator
 - .8 Liquid Crystal Display (LCD)
- .2 Menu driven LCD that displays operating conditions, warning messages, and fault indication messages for the unit.
 - .1 Operating conditions display:
 - .1 Input voltage
 - .2 Output voltage
 - .3 Input frequency
 - .4 Output frequency
 - .5 Output current
 - .6 Battery voltage
 - .7 Battery test results
 - .8 Output voltage adjustment
 - .9 Number of battery discharges
 - .10 Number of faults
 - .11 UPS ON/OFF Line
 - .2 Warning messages:
 - .1 Overload
 - .2 Current limit
 - .3 Emergency power off
 - .4 Battery discharge
 - .5 I/O not synchronized

2.5 FABRICATION

- .1 Shop assemble all system components/units
- .2 Interconnect units and controls to produce complete uninterruptible power systems.

3.0 EXECUTION**3.1 INSTALLATION**

- .1 Mount uninterrupted power system (UPS).
- .2 Ensure adequate clearance around UPS for ventilation.
- .3 Install UPS in level upright position.
- .4 Remove shipping supports only after UPS is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections in accordance with wiring diagram.
- .7 Energize UPS after installation is complete.
- .8 Instruct operating personnel in the care, operation and maintenance of the unit in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for primary lighting arresters.
- .2 Edit this section to suit project requirements.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.

1.3 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE C62.36, Standard Test Methods for Surge Protectors Used in Low Voltage Data Communications and Signaling Circuits, Standard Test Methods.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C233.1, Gapless Metal Oxide Surge Arresters for Alternating Current Systems.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Arrester component parts: to CAN/CSA-C233.1 and ANSI/IEEE-C62.36.
- .2 Arrester characteristics:
 - .1 Station, intermediate or distribution type arrester, as indicated on drawings.
 - .2 System highest voltage line to line, line to ground or direct grounded, as indicated.
 - .3 MCOB (maximum continuous operating voltage): as indicated.
 - .4 Outdoor or indoor type, as indicated.

.5 Radio influence voltage: as indicated.

.6 Housing: polymer.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Mount arresters on cross arms adjacent to service cable pot head and as close to transformer as possible.
- .2 Connect line terminals to phase conductors.
- .3 From arrester ground terminal run copper ground wire down pole to ground rod, size as indicated.
- .4 From arrester ground terminal run shortest possible conductor to secondary neutral of transformer, size as indicated.
- .5 Mount arresters adjacent to primary bus of primary switchgear and connect line terminals to phase conductors. Connect ground terminals to ground bus.

END OF SECTION

1.0 GENERAL**1.1 SECTION INCLUDES**

- .1 Equipment and installation for secondary lighting arresters.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 REFERENCES

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41, Practice on Surge Voltages in Low-Voltage AC Power Circuits.
 - .2 Underwriters' Laboratories of Canada (ULC)
 - .1 UL 1449, Standard for Surge Protective Devices.

2.0 PRODUCTS**2.1 EQUIPMENT**

- .1 Arrester component parts: to ANSI/IEEE C62.41 and UL 1449.
 - .2 Arrester characteristics:
 - .1 System voltage: 600.
 - .2 Rated voltage of arrester: 650 V.
 - .3 Indoor type.

3.0 EXECUTION**3.1 INSTALLATION**

- .1 Install arresters in switchboard and connect to secondary bus and ground bus.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Gas Association (CGA)
 - .1 CGA Recommended Practice OCC-1, for the control of external corrosion on buried or submerged metallic piping systems.
- .2 Canadian Standards Association (CSA)
 - .1 CSA C22.3 No.4- Control of Electrochemical Corrosion of Underground Metallic Structures.
- .3 National Association of Corrosion Engineers (NACE)

1.3 SUBMITTALS

- .1 Indicate location of anodes, test positions, connecting cables, wire splicing details, installation procedures, power supply, hardware and accessories.

1.4 WARRANTY

- .1 Contractor hereby warrants that the cathodic protection will be effective in accordance with General Conditions, for a period of five years.

2.0 PRODUCTS

2.1 EQUIPMENT

- .1 Provide complete cathodic protection system as indicated, comprising galvanic or sacrificial anodes having a minimum design life, of 25 years: to CSA 22.3 No.4.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install system including bonding of system to structure as indicated.
- .2 Locate test stations in weatherproof housings as indicated.

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Section 264200
Cathodic Protection

-
- .3 Make joints and connections by means of thermit welding. Bond pipelines to structure.

END OF SECTION

1.0 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
 - .2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 United States of America, Federal Communications Commission (FCC)
 - .1 FCC (CFR47) EM and RF Interference Suppression.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 43 00 - Quality Assurance.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.3 SUBMITTALS

- .1 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Region's Representative.
- .2 Photometric data to include: VCP Table and spacing criterion and luminaire coefficient of utilization (CU) tables.
- .3 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Quality assurance submittals: provide the following in accordance with Section 01 43 00 - Quality Assurance.

- .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures and relamping schedule.
- .5 Submit product literature for each type of lamp supplied, complete with the mercury content of each lamp.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Divert unused metal materials from landfill to metal recycling facility.
- .4 Disposal and recycling of fluorescent lamps as per local regulations.
- .5 Disposal of old PCB filled ballasts.

1.5 ACCEPTABLE PRODUCTS

- .1 Luminaires described in the Lighting Fixture Schedule identify quality, performance criteria and other parameters, as indicated for this project. Named fixtures are acceptable with modifications and accessories, as indicated.
- .2 Fixtures from other manufacturers may be acceptable provided:
 - .1 Appearance and lighting performance are similar.
 - .2 Quality is equal or better.
 - .3 Lamp and ballast criteria remain the same.
 - .4 The fixture is provided with modifications and accessories to provide a complete product in keeping with the intent of the project.
 - .5 Approval in writing is obtained from the Region's Representative to the supplier/manufacturer five (5) days prior to tender closing date.

2.0 PRODUCTS

2.1 LAMPS

- .1 Incandescent lamps to be - clear, A19, 100 Watt with 1000 hour lamp life, rough-service rated; or as indicated.

-
- .2 Tungsten halogen lamps to be - clear, T-3, 300 Watt, RSC base, 2000 hour lamp life, 5000 lumens; or as indicated.
 - .3 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid or instant start to suit application, 4100 K, 30,000 hour lamp life, 2950 initial lumens, CRI 80; or as indicated.
 - .4 Metal halide lamps to be - clear, BT37, 400 Watt, mogul base, horizontal burn, 4100 K, 15,000 hour lamp life, 36,000 initial lumens, CRI65, open or enclosed type to suit the luminaire; or as indicated.
 - .5 Low pressure sodium lamps to be - clear, T21, 135 Watt, BY22d base, horizontal burn, 16,000 hour lamp life, 22,000 initial lumens; or as indicated.
 - .6 High pressure sodium lamps to be - clear, ED18, 400 Watt, mogul base, 30,000 hour lamp life, 54,000 initial lumens; or as indicated.
 - .7 Compact fluorescent lamps to be - 18 Watt, G24q-2 base, 12,000 hour lamp life, 12,000 initial lumens, 4100 K, CRI 80; or as indicated.
 - .8 LED, as indicated.

2.2 BALLASTS

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic.
 - .1 Rating: 120 or 347 V, 60 Hz, as indicated, for use with 2-32W, T8 octron imperial lamps.
 - .2 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.
 - .3 Totally encased and designed for 40 °C ambient temperature.
 - .4 Power factor: minimum 98 % with 98% of rated lamp lumens.
 - .5 Crest factor: 1.5 maximum.
 - .6 Capacitor: thermally protected.
 - .7 Thermal protection: non-resettable on coil.
 - .8 Harmonics: 10 % maximum THD.
 - .9 Operating frequency of electronic ballast: 20 khz minimum.
 - .10 Total Circuit Power: 62 Watts.
 - .11 Ballast Factor: greater than 0.90.

-
- .12 Sound rated: Class A.
 - .13 Mounting: integral with luminaire.
 - .14 Be warranted by manufacturer for five years.
 - .2 Metal halide ballast: design B.
 - .1 Rating: 60 Hz voltage as indicated, for use with metal halide lamp as indicated. Provide circuitry for standby light to provide light for starting and restart.
 - .2 Totally encased and designed for 40 °C ambient temperature.
 - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
 - .4 Type: constant wattage auto-transformer or solid state.
 - .5 Input voltage range: plus or minus 10% of nominal.
 - .6 Minimum starting temperature: minus 29 °C at 90% line voltage.
 - .7 Mounting: outdoor integral with luminaire.
 - .8 Current crest factor: 1.7 maximum current.
 - .3 High pressure sodium ballast: to ANSI C82.4 design C.
 - .1 Rating: 60Hz voltage as indicated, for use with high pressure sodium lamps, as indicated.
 - .2 Totally encased and designed for 40 °C ambient temperature.
 - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
 - .4 Type: reactor or solid state with matching igniter as recommended by manufacturer.
 - .5 Input voltage range: plus 10% to minus 10% of nominal.
 - .6 Minimum starting temperature: minus 34 °C at 90% line voltage.
 - .7 Mounting: outdoor integral with luminaire.
 - .8 Current crest factor: 1.7 maximum current.
 - .4 Low pressure sodium ballast: design D.
 - .1 Rating: 60 Hz voltage as indicated, for use with low pressure sodium lamps as indicated.

-
- .2 Totally encased and designed for 40 °C ambient temperature.
 - .3 Power factor: minimum 95% with 95% of rated lamp lumens.
 - .4 Type: constant wattage.
 - .5 Input voltage range: plus or minus 20% of nominal.
 - .6 Minimum starting temperature: minus 34 °C at 90% line voltage.
 - .7 Mounting: outdoor integral with luminaire.
 - .5 LED drivers:
 - .1 General requirements:
 - .1 Designed for 10 year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
 - .2 Designed and tested to withstand electrostatic discharges without impairment of performance when tested according to IEC 61000-4-2.
 - .3 UL 8750 recognized or listed as applicable.
 - .4 Complies with IEC 61347-2-13 as applicable.
 - .5 Surge Tolerance: Designed and tested to withstand Category A surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.
 - .6 Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
 - .7 Class A sound rating; inaudible in a 27 dBA ambient.
 - .8 No visible change in light output with a variation of plus or minus 10 percent line voltage input.
 - .9 Total Harmonic Distortion (THD): Less than 20 percent for loads greater than 25W; complies with ANSI C82.11.
 - .10 Drivers to track evenly across multiple lamp lengths and all light levels.
 - .11 Configuration tool available to optimize the following for LED fixtures:
 - .1 Light level.

.2 Efficacy.

.3 Thermal performance.

.2 3-wire control:

.1 Provide integral fault protection to prevent driver failure in the event of a mis-wire.

.2 Operate from input voltage of 120 V through 347 V at 60 Hz, or as indicated.

.3 Product(s):

.1 Maximum Inrush Current: Meets NEMA 410 inrush requirements.

.2 Constant Current Drivers:

.1 Support from 220 mA to 1.4 A to ensure a compatible driver exists.

.2 Support LED arrays up to 60W.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 LUMINAIRES

.1 As indicated in luminaire schedule on drawings. Provide 10% spare lamps of each type noted in luminaire schedule.

2.5 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule on drawings.

3.0 EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated. Install lamps in all fixtures.

.1 Provide adequate support to suit ceiling system.

3.2 WIRING

- .1 Connect luminaires to lighting circuits.
 - .1 Install flexible conduit for vertical power supply drop to luminaires as indicated. Horizontal wiring using flexible conduit is not permitted.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires from ceiling grid in accordance with local inspection requirements.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results – Electrical.
- .4 Section 26 05 21 - Wires and Cables (0-1000 V).
- .5 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

- .1 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WARRANTY

- .1 For batteries, the ten years warranty period is extended to 120 months, with no-charge replacement during the first five (5) years and pro-rate charge on the second five (5) years from the date of Substantial Completion.

2.0 PRODUCTS

2.1 EQUIPMENT

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 V, ac.
- .3 Output voltage: 12 or 24 V dc (*edit to suit*).
- .4 Operating time: as required by the latest edition of the NBC (*edit to suit*).
- .5 Battery: sealed, maintenance free.

-
- .6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
 - .7 Solid state transfer circuit.
 - .8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
 - .9 Signal lights: solid state, for 'AC Power ON'.
 - .10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: micro-tungsten or sealed beam as indicated.
 - .11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
 - .12 Finish: standard.
 - .13 Auxiliary equipment:
 - .1 Test switch.
 - .2 Time delay relay.
 - .3 Battery disconnect device.
 - .4 AC input and DC output terminal blocks inside cabinet.
 - .5 Shelf.
 - .6 Cord and single twist-lock plug connection for AC.
 - .7 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

- .1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V) sized as indicated in accordance with manufacturer's recommendations.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install unit equipment and remote mounted fixtures.

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Section 265213.13

Emergency Lighting

- .2 Direct heads.
- .3 Connect exit lights to unit equipment.
- .4 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and in accordance with Section 01 91 13 – General Commissioning (Cx) requirements.

END OF SECTION

1.0 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 00 - Cleaning.
- .3 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .4 Section 26 05 00 - Common Work Results – Electrical.

1.2 REFERENCES

- .1 Atomic Energy Control Board Regulations
- .2 Canadian Code for Preferred Packaging
- .3 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.
 - .2 CSA C860, Performance of Internally-Lighted Exit Signs.
- .4 National Fire Protection Association (NFPA)
 - .1 NFPA 101, Life Safety Code.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures and disposal.

2.0 PRODUCTS**2.1 STANDARD UNITS**

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Electrical Code for Preferred Packaging guidelines.
- .2 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish
- .3 Face and back plates: extruded aluminum.

-
- .4 Lamps: multiple - LED-12 W, 120 V, over 500,000 hours with average surface brightness of 3000 candela.
 - .5 Operation: designed for 25 years of continuous operation without relamping.
 - .6 Letters: 150 mm high x 19 mm, with 13 mm thick stroke red on extruded aluminum face, reading EXIT.
 - .7 Downlight: white glass in bottom of unit.
 - .8 Third lamp socket for emergency lamp lighting circuit.
 - .9 Face plate to remain captive for relamping.

2.2 SELF-POWERED UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.
- .2 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish.
- .3 Face and back plates: extruded aluminum.
- .4 Lamps: multiple - , LED-12W 120 V over 500,000 hours.
- .5 Operation: designed for 25 years of continuous operation without relamping.
- .6 Letters: 150 mm high x 19 mm wide, with 13 mm thick stroke, red on extruded aluminum face, reading EXIT.
- .7 Downlight: white glass in bottom of unit.
- .8 Third lamp socket for emergency lamp lighting circuit.
- .9 Face plate to remain captive for relamping.
- .10 Supply voltage: 120 V, ac.
- .11 Output voltage: 12 or 24 V dc.
- .12 Operating time: minimum 30 minutes and as required by code.
- .13 Recharge time: 12 hours
- .14 Battery: sealed, maintenance free, warranty to Section 26 52 13.13 – Emergency Lighting.

-
- .15 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
 - .16 Solid state transfer circuit.
 - .17 Signal lights: solid state, for 'AC Power ON'.
 - .18 Lamp heads: integral on unit, 345° horizontal and 180° vertical adjustment. Lamp type: as indicated.
 - .19 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
 - .20 Cabinet: finish: standard.
 - .21 Auxiliary equipment:
 - .1 Lamp disconnect switch.
 - .2 Test switch.
 - .3 AC/DC output terminal blocks inside cabinet.
 - .4 RFI suppressor.
 - .5 Cord and single twist-lock plug connection for AC power supply.

2.3 DESIGN X1

- .1 Recessed, wall, end to wall, ceiling mounting as indicated.
- .2 Single or double face with face plate to remain captive for relamping as indicated.
- .3 Arrow: right or left as indicated.
- .4 Wireguard.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits using RW90 wire in EMT conduit.

- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.
- .5 Provide tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

3.2 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1.0 GENERAL

1.1 REFERENCES

- .1 Aluminum Association (AA)
 - .1 DAF 45, Designation System for Aluminum Finishes.
- .2 ASTM International
 - .1 ASTM A1008/A1008M-12a, Standard Specification for Steel, Sheet. Cold Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - .2 ASTM E2072, Standard Specification for Photoluminescent (Phosphorescent) Safety Markings.
 - .3 ASTM E2073, Standard Test Method for Photopic Luminance of Photoluminescent (Phosphorescent) Markings.³
- .3 CSA Group
 - .1 CSA B651, Accessible Design for the Built Environment.
- .4 International Standards Organization (ISO)
 - .1 ISO 3864-1, Graphic Symbols - Safety Colours and Safety Signs - Part 1: Design Principles for Safety Signs and Safety Markings.
 - .2 ISO 7010, Graphic Symbols - Safety Colours and Safety Signs - Registered Safety Signs.
- .5 Intertek
 - .1 ETL Listed Mark.
- .6 National Building Code of Canada (NBC).
- .7 National Fire Protection Association (NFPA)
 - .1 NFPA 101, Life Safety Code.
- .8 Underwriters Laboratories Inc. (UL)
 - .1 UL-924, Standard for Emergency Lighting and Power Equipment.
- .9 Underwriters Laboratories' of Canada (ULC)

- .1 CAN/ULC-S572, First Edition Standard for Photoluminescent and Self-Luminous Exit Signs and Path Markings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for photoluminescent exit signs and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Samples:
 - .1 Submit full size sample of each type and pattern of photoluminescent exit sign.
 - .2 Submit sample of each frame material and finish.
- .3 Shop Drawings:
 - .1 Provide shop drawings showing details, dimensions, exit sign locations, mounting heights and attachments.
- .4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
 - .1 ULC certification.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit manufacturer's cleaning procedures and schedule for periodic visibility inspections.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect photoluminescent exit signs from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.5 WARRANTY

- .1 Provide a written guarantee, signed and issued in the name of the Region's Representative, covering the photoluminescent exit signs for both material and workmanship for a period of 5 (five) years from the date of Substantial Completion.

2.0 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Design Criteria:
 - .1 Exit Signs: design to NBC, Division B, article 3.4.5.
 - .2 Interior exit signs: ULC listed and labeled to CAN/ULC-S572.

2.2 MATERIALS

- .1 Aluminum:
 - .1 Aluminum extrusion to AA alloy 6063-T6, clear anodizing to DAF 45.
- .2 Aluminum sheet to AA1100, clear anodizing to DAF 45.
- .3 Photoluminescent material (PLM): strontium aluminate.

2.3 PHOTOLUMINESCENT EXIT SIGN FABRICATION

- .1 Photoluminescent (PLM) exit sign to CAN/ULC-S572, aluminum recyclable, non-toxic, ULC listed for indoor, complete with mounting bracket, single or double face, thin, low profile design, explosion proof.
- .2 Interior visibility: 22.9 m minimum.
- .3 Letters: size to be in accordance with CAN/ULC-S572.
 - .1 Sign face: aluminum sheet with visibility green background and photoluminescent markings.
 - .2 Directional chevrons: 2 (two) per side.
 - .3 Running person: to CAN/ULC-S572.
 - .4 Directional indicator: arrows 1 or 2 per side, as required.
 - .5 Mounting: surface mounted, ceiling/pendent mounted or wall mounted, as indicated.
 - .6 Mounting Bracket: manufacturer's standard aluminum mounting system, clear anodized.

- .7 Frame: aluminum housing, clear anodized.
- .8 Charging: minimum 54 lux of light on faces of sign at all times during building occupation.
- .9 Sign size with frame: 235 mm high x 365 mm wide.
- .10 “EXIT” lettering to be 175 mm high x 22 mm wide.

2.4 EXIT SIGN TYPES

.1 PLM EXIT SIGN TYPE 1

- .1 Screen printed exit sign:
 - .1 Language: English - “EXIT”.
 - .2 22.9 m viewing visibility.
 - .3 Single face.
 - .4 Aluminum frame.
 - .5 Surface mount.
 - .6 Arrows/Chevrons: right, left or both directions, as required.
 - .7 Durability: explosion proof.

.2 PLM EXIT SIGN TYPE 2

- .1 Screen printed exit sign:
 - .1 Language: English – “EXIT”.
 - .2 22.9 m viewing visibility.
 - .3 Single face.
 - .4 Aluminum frame.
 - .5 Ceiling/pendant or wall mount.
 - .6 Arrows/Chevrons: right, left or both directions, as required.
 - .7 Durability: explosion proof.

.3 PLM EXIT SIGN TYPE 3

- .1 Screen printed exit sign:
 - .1 Language: English – “EXIT”.

-
- .2 22.9 m viewing visibility.
 - .3 Double face.
 - .4 Aluminum frame.
 - .5 Ceiling/pendant or wall mount.
 - .6 Arrows/Chevrons: : right, left or both directions, as required.
 - .7 Durability: explosion proof.
 - .4 PLM Exit Sign Type 4
 - .1 Screen printed exit sign:
 - .1 Language: English – “EXIT”.
 - .2 22.9 m viewing visibility.
 - .3 Double face.
 - .4 Aluminum frame.
 - .5 Ceiling/pendant or wall mount.
 - .6 No Arrows/Chevrons.
 - .7 Durability: explosion proof.
 - .5 PLM Exit Sign Type 5
 - .1 Screen printed exit sign:
 - .1 Language: English – “EXIT”.
 - .2 22.9 m viewing visibility.
 - .3 Single face.
 - .4 Aluminum frame.
 - .5 Surface mount.
 - .6 No Arrows/Chevrons.
 - .7 Durability: explosion proof.
 - .6 PLM EXIT SIGN TYPE 6
 - .1 Screen printed green pictogram (Running Person) exit sign:

-
- .1 22.9 m viewing visibility.
 - .2 Right facing.
 - .3 Single face.
 - .4 Aluminum frame.
 - .5 Surface mount.
 - .6 No Arrow/Chevron.
 - .7 Durability: explosion proof.
- .7 PLM EXIT SIGN TYPE 7
- .1 Screen printed green pictogram (Running Person) exit sign.
 - .2 22.9 m viewing visibility.
 - .3 Right facing.
 - .4 Single face.
 - .5 Aluminum frame.
 - .6 Ceiling/pendant or wall mount.
 - .7 No Arrow/Chevron.
 - .8 Durability: explosion proof.
- .8 PLM EXIT SIGN TYPE 8
- .1 Screen printed green pictogram (Running Person) exit sign:
 - .2 22.9m viewing visibility.
 - .3 Left facing.
 - .4 Single face.
 - .5 Aluminum frame.
 - .6 Surface mount.
 - .7 No Arrow/Chevron.
 - .8 Durability: explosion proof.

.9 PLM EXIT SIGN TYPE 9

- .1 Screen printed green pictogram (Running Person) exit sign:
- .2 22.9 m viewing visibility.
- .3 Left facing.
- .4 Single face.
- .5 Aluminum frame.
- .6 Ceiling/pendant or wall mount.
- .7 No Arrow/Chevron.
- .8 Durability: explosion proof.

.10 PLM EXIT SIGN TYPE 10

- .1 Screen printed green pictogram (Running Person) exit sign:
- .2 22.9 m viewing visibility.
- .3 Left facing and right facing.
- .4 Double face.
- .5 Aluminum frame.
- .6 Ceiling/pendant or wall mount.
- .7 No Arrow/Chevron.
- .8 Durability: explosion proof.

.11 PLM EXIT SIGN TYPE 11

- .1 Screen printed green pictogram (Running Person) exit sign:
- .2 22.9 m viewing visibility.
- .3 Right facing.
- .4 Single face.
- .5 Aluminum frame.
- .6 Surface mount.

.7 With pictogram arrow.

.8 Durability: explosion proof.

.12 PLM EXIT SIGN TYPE 12

.1 Screen printed green pictogram (Running Person) exit sign:

.2 22.9 m viewing visibility.

.3 Right facing.

.4 Single face.

.5 Aluminum frame.

.6 Ceiling/pendant or wall mount.

.7 With pictogram arrow.

.8 Durability: explosion proof.

.13 PLM EXIT SIGN TYPE 13

.1 Screen printed green pictogram (Running Person) exit sign.

.2 22.9 m viewing visibility.

.3 Left facing.

.4 Single face.

.5 Aluminum frame.

.6 Surface mount.

.7 With pictogram arrow.

.8 Durability: explosion proof.

.14 PLM EXIT SIGN TYPE 14

.1 Screen printed green pictogram (Running Person) exit sign:

.2 22.9 m viewing visibility.

.3 Left facing.

.4 Single face.

.5 Aluminum frame.

- .6 Ceiling/pendant or wall mount.
- .7 With pictogram arrow.
- .8 Durability: explosion proof.
- .15 PLM EXIT SIGN TYPE 15
 - .1 Screen printed green pictogram (Running Person) exit sign:
 - .2 22.9 m viewing visibility.
 - .3 Left facing and right facing, as required.
 - .4 Double face.
 - .5 Aluminum frame.
 - .6 Ceiling/pendant or wall mount.
 - .7 With pictogram arrow.
 - .8 Durability: explosion proof.

3.0 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for PLM exit sign installation in accordance with manufacturer's written instructions.
 - .1 Inform Region's Representative of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

- .1 Install components in accordance with manufacturer's written recommendations.
- .2 Install in locations indicated on drawings and in accordance with NBC.

- .3 Install level, square, plumb and with surface.
- .4 Upon completion of installation verify performance of PLM exit signs.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .1 Clean PLM exit sign face with a non-abrasive cloth dampen with water. Do not use chemical solvents.

3.5 PROTECTION

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

END OF SECTION

1.0 GENERAL**1.1 GENERAL**

- .1 This section describes the extent of services to be provided for wiring of equipment supplied by others.
- .2 Within the context of this section, Others means:
 - .1 Other divisions of this specification
 - .2 The Region's Representative, as defined in the Contract.
 - .3 Other contractors supplying and installing equipment to the contract.

1.2 EXTENT OF SERVICES PROVIDED

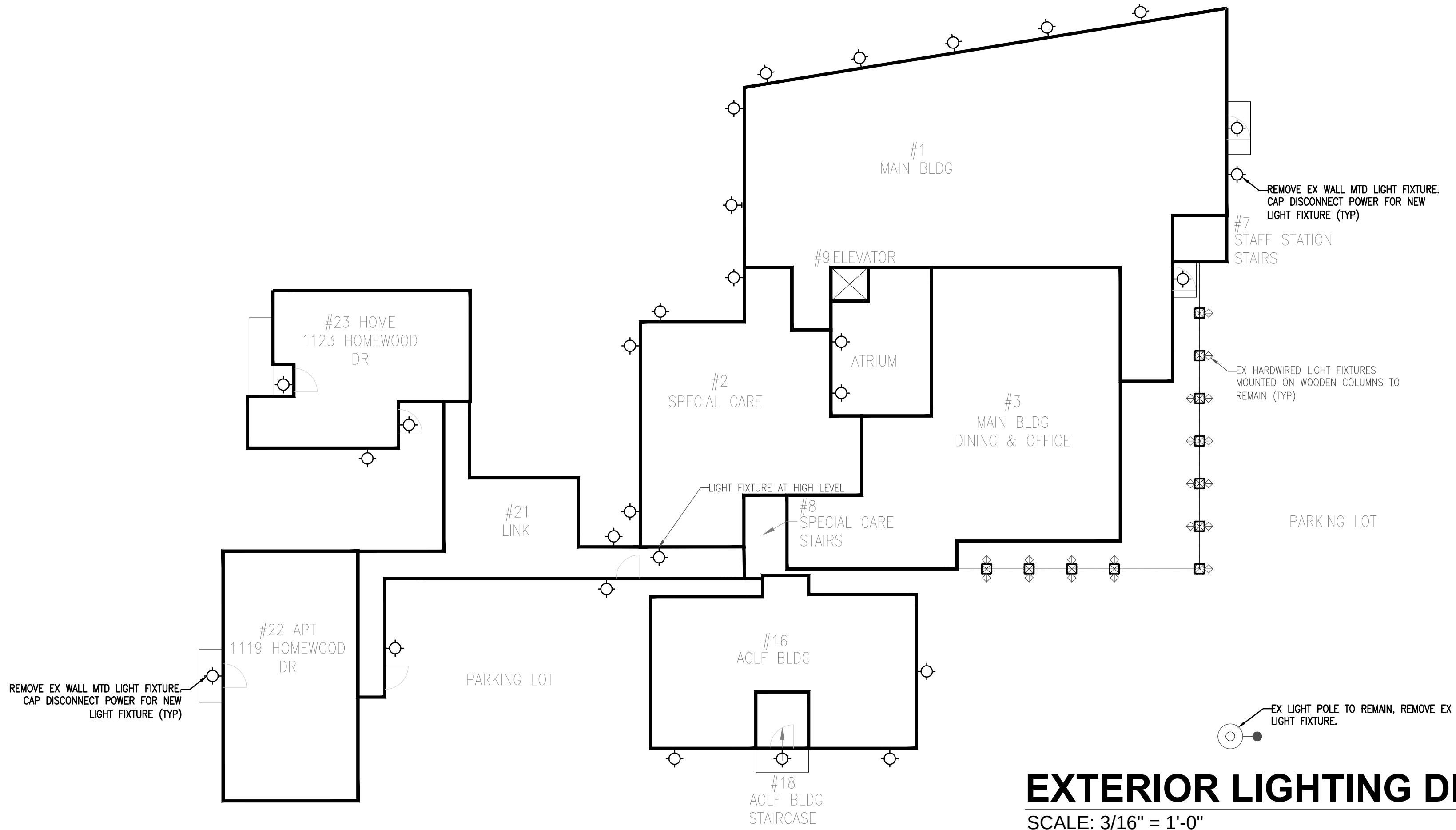
- .1 The work of this contract is to include all power and control wiring of equipment which is provided by Division 26.
- .2 All power and control wiring associated with equipment supplied by Division 01 will be the responsibility of this Contractor. Coordinate with general contractor for exact requirements.
- .3 Final connection of all wiring to equipment provided by others will be by division 26. Coordinate with the provider for connection instructions.

1.3 RESPONSIBILITY OF DIVISION 26

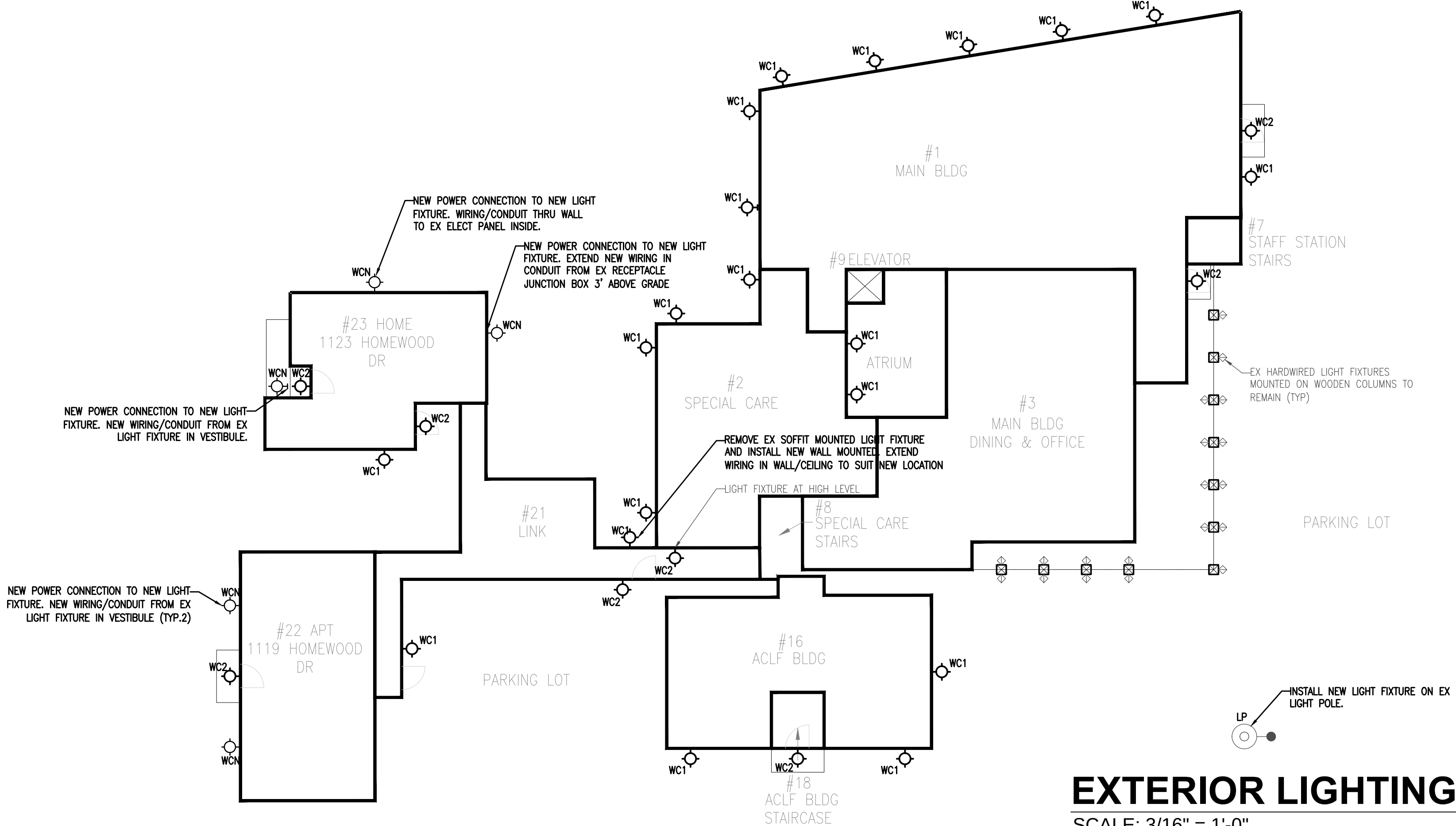
- .1 It is the responsibility of the Division 26 subcontractor to verify final requirements for wiring of all equipment noted. Verification of wiring requirements to include:
 - .1 Confirmation of electrical characteristics.
 - .2 Location of connection point.
 - .3 Method of connection (i.e. direct or plug-in etc.)
- .2 Obtain and become familiar with shop drawings for all relevant equipment.
- .3 No claim for extra will be entertained for wiring equipment which has been indicated, or changes to installed wiring where installation proceeded prior to verification of electrical requirements.

2.0 PRODUCTS (NOT APPLICABLE)**3.0 EXECUTION (NOT APPLICABLE)****END OF SECTION**

ATTACHMENT A
DRAWING SET: ELECTRICAL AND MECHANICAL

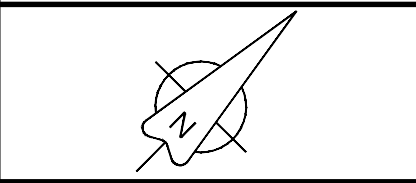


EXTERIOR LIGHTING DEMO PLAN
SCALE: 3/16" = 1'-0"



EXTERIOR LIGHTING NEW PLAN
SCALE: 3/16" = 1'-0"

GENERAL NOTES:
CONTRACTOR TO CHECK DRAWINGS AND VERIFY DIMENSIONS ON THE JOB.
REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH CONSTRUCTION OR SHOP FABRICATION.
DO NOT SCALE DRAWINGS.
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APPROVED BY:

–	–	–	–
–	–	–	–
–	–	–	–
–	–	–	–
–	–	–	–
–	–	–	–
03	MAR.26.26	MK	ISSUED FOR TENDER
02	NOV.27.25	MK	ISSUED FOR TENDER
01	MAY.23.25	MK	ISSUED FOR REVIEW

REV. DATE NAME DESCRIPTION

CLIENT:



CONSULTANT:

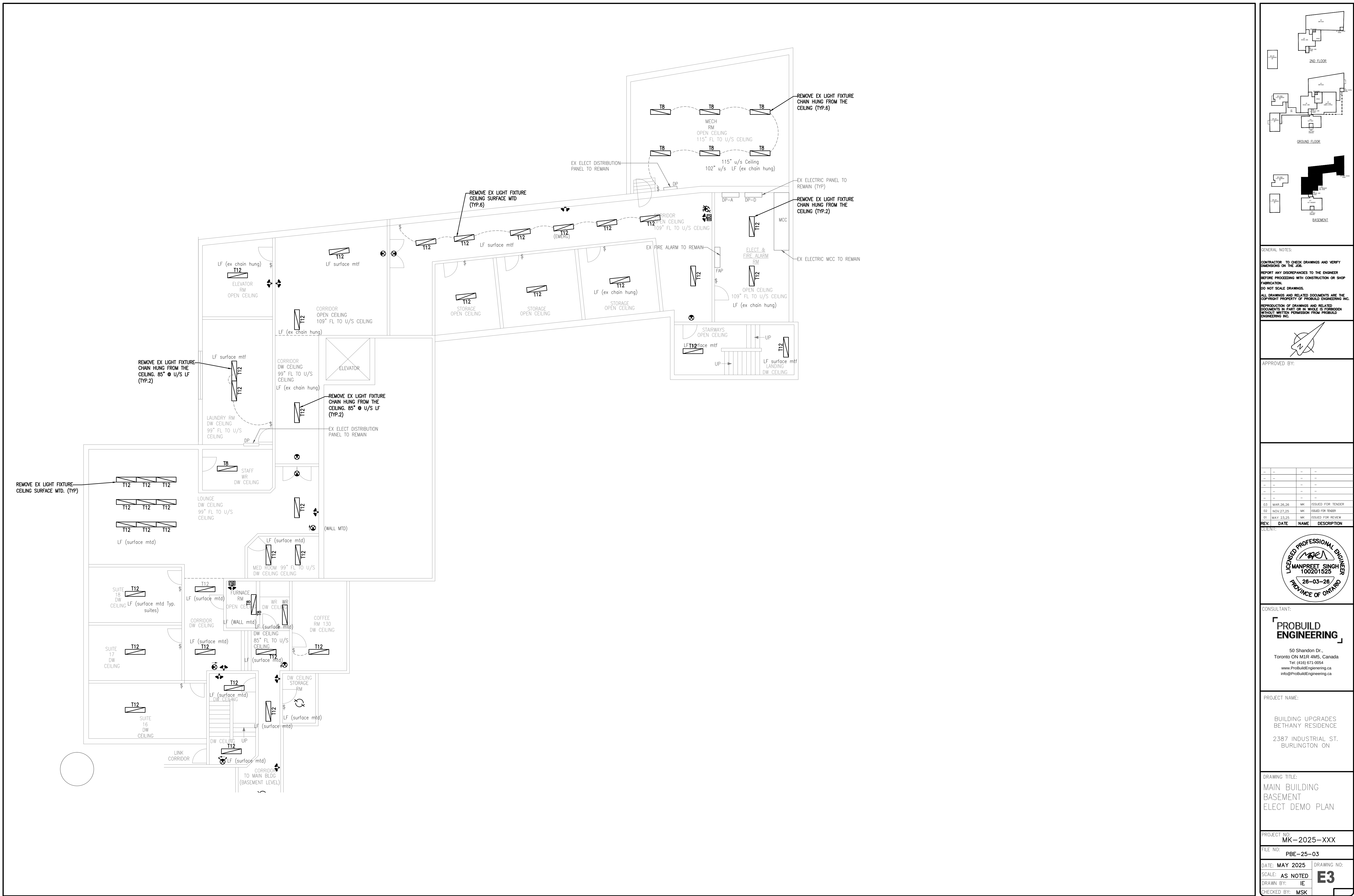
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www.ProBuildEngineering.ca
info@ProBuildEngineering.ca

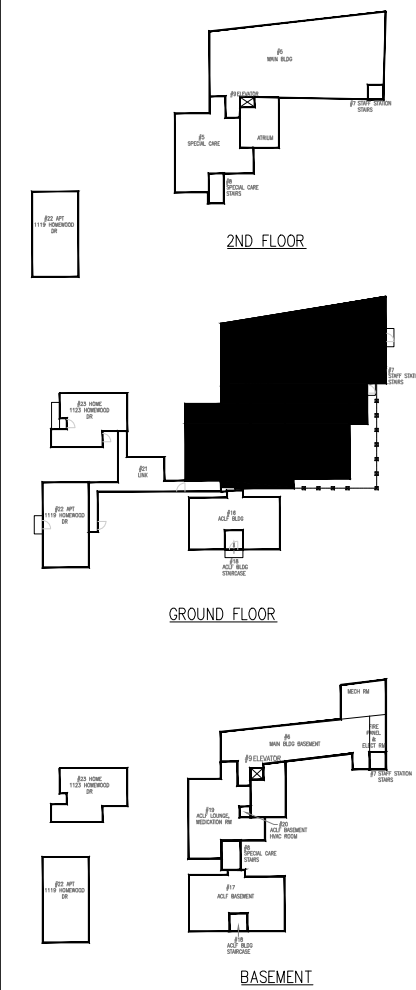
PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:
ELECT EXTERIOR
LIGHTING PLAN

PROJECT NO: MK-2025-XXX	
FILE NO: PBE-25-03	
DATE: MAY 2025	DRAWING NO:
SCALE: AS NOTED	E2
DRAWN BY: IE	
CHECKED BY: MSK	





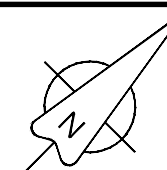
GENERAL NOTES

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1992	1992	1992	1992
1992	1992	1992	1992
1992	1992	1992	1992
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03	MAR.26,26	MK	ISSUED FOR TEND
02	NOV.27,25	MK	ISSUED FOR TENDER
01	MAY 23,25	MK	ISSUED FOR REVIEW
REV.	DATE	NAME	DESCRIPTION

CLIENT



CONSULTANT



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info@ProBuildEngineering.ca

PROJECT NAME

BUILDING UPGRADES
BETHANY RESIDENCE
2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:

MAIN BUILDING GF
ELECT DEMO PLAN

PROJECT NO:

PROJECT NO. MK-2025-XXX

FILE NO: PBE-25-03

DATE: MAY 2025

SCALE: 10 NOTES

DRAWN BY: IF

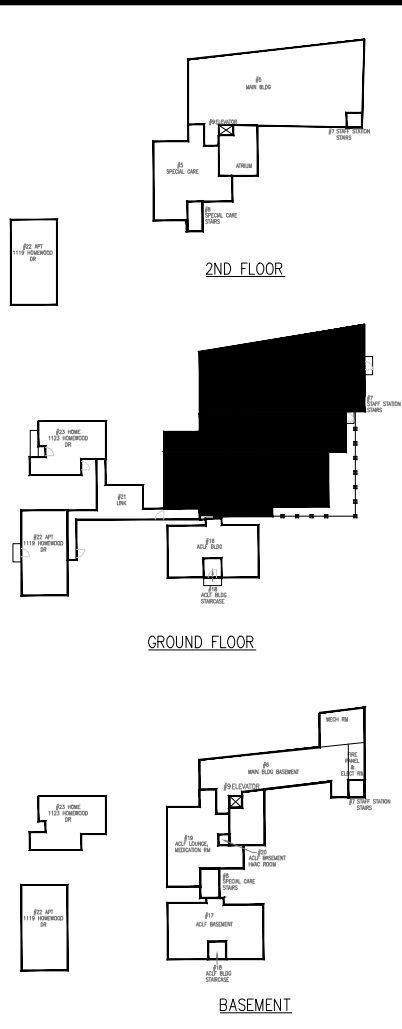
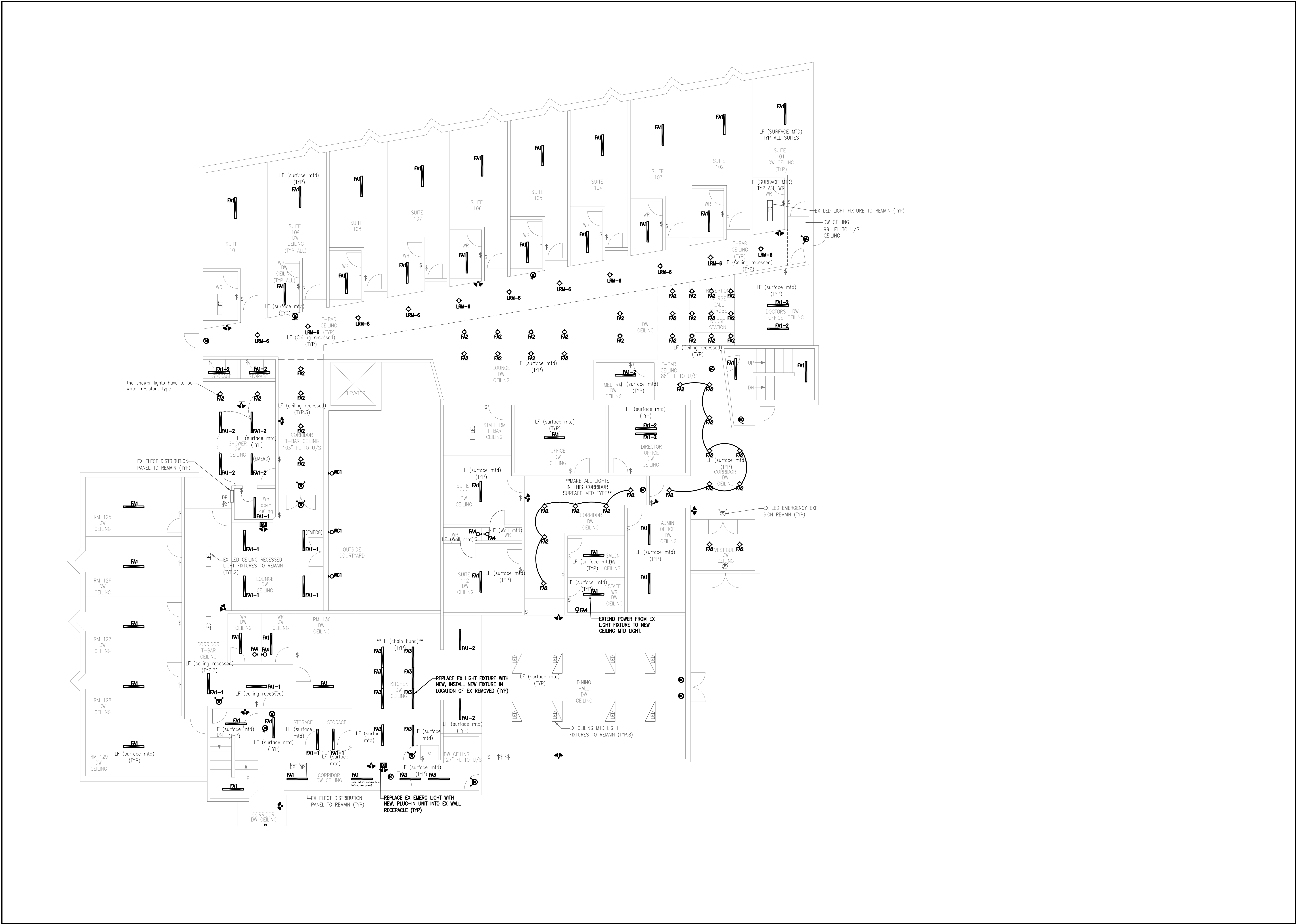
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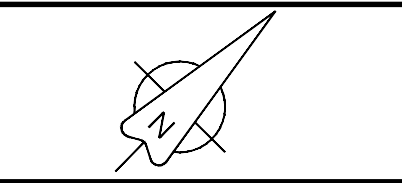
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E4

7



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01	MAY.23.25	MSK	ISSUED FOR REVIEW

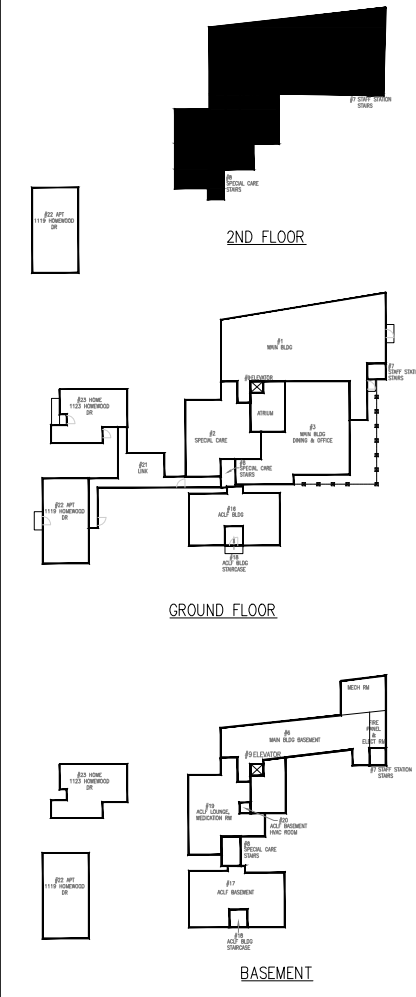


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PROJECT NAME:
BUILDING UPGRADES
BETHANY RESIDENCE
2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:
MAIN BUILDING GF
ELECT NEW PLAN

PROJECT NO:
MK-2025-XXX
FILE NO:
PBE-25-03
DATE: MAY 2025
SCALE: AS NOTED
DRAWN BY: IE
CHECKED BY: MSK
DRAWING NO:
E7



GENERAL NOTES:

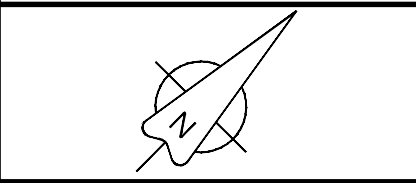
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info@ProBuildEngineering.ca

PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE

2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:

MAIN BUILDING SF
ELECT NEW PLAN

PROJECT NO:
MK-2025-XXX

FILE NO:
PBE-25-03

DATE: MAY 2025	DRAWING NO:
SCALE: AS NOTED	E8
DRAWN BY: IE	
CHECKED BY: MSK	



FIRST FL DEMO PLAN
SCALE: 1/8" = 1'-0"



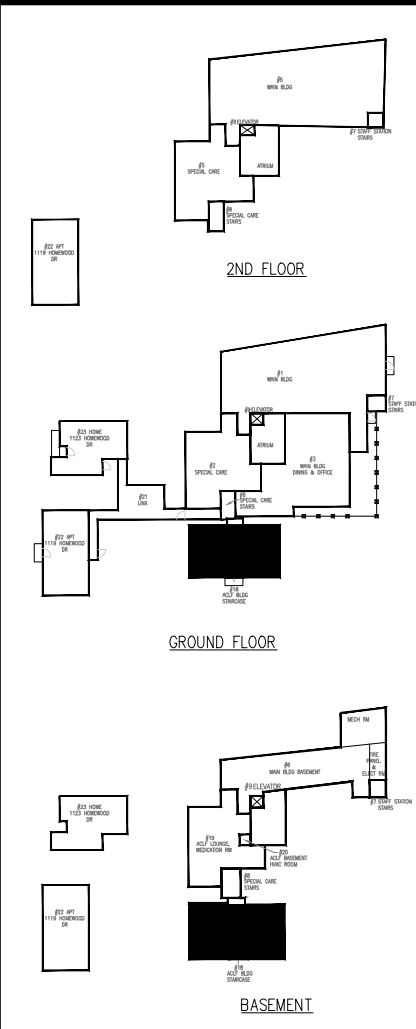
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SCALE: 1/8" = 1'-0"



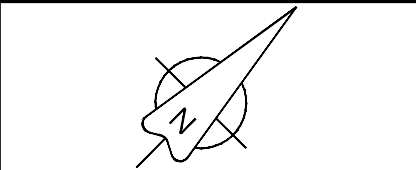
FIRST FL NEW PLAN
SCALE: 1/8" = 1'-0"



BASEMENT FL NEW PLAN
SCALE: 1/8" = 1'-0"



GENERAL NOTES:
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01	MAY.23.25	MK	ISSUED FOR REVIEW

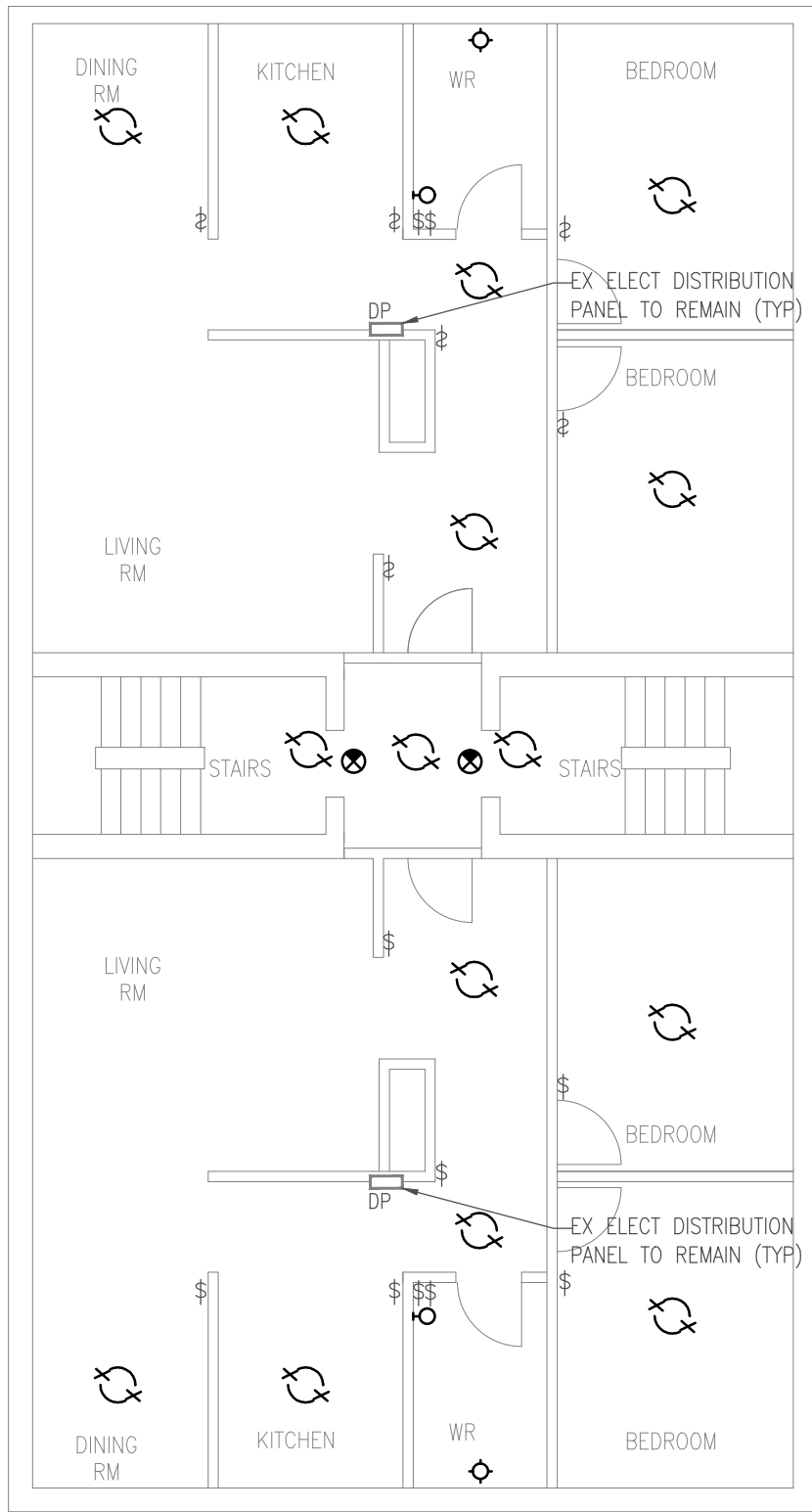


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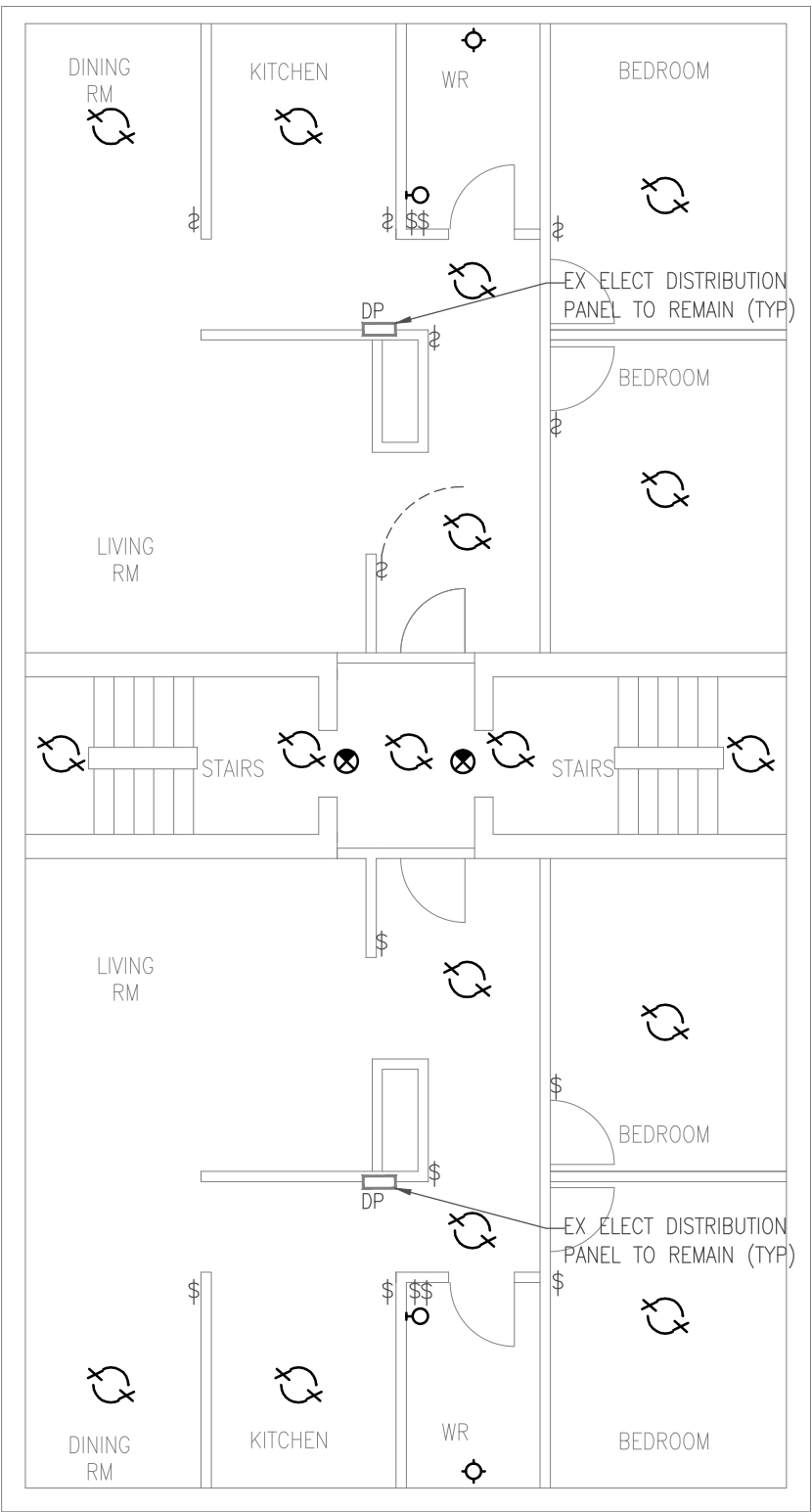
PROJECT NAME:
BUILDING UPGRADES
BETHANY RESIDENCE
2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:
ACLF BLDG ELECT
DEMO & NEW

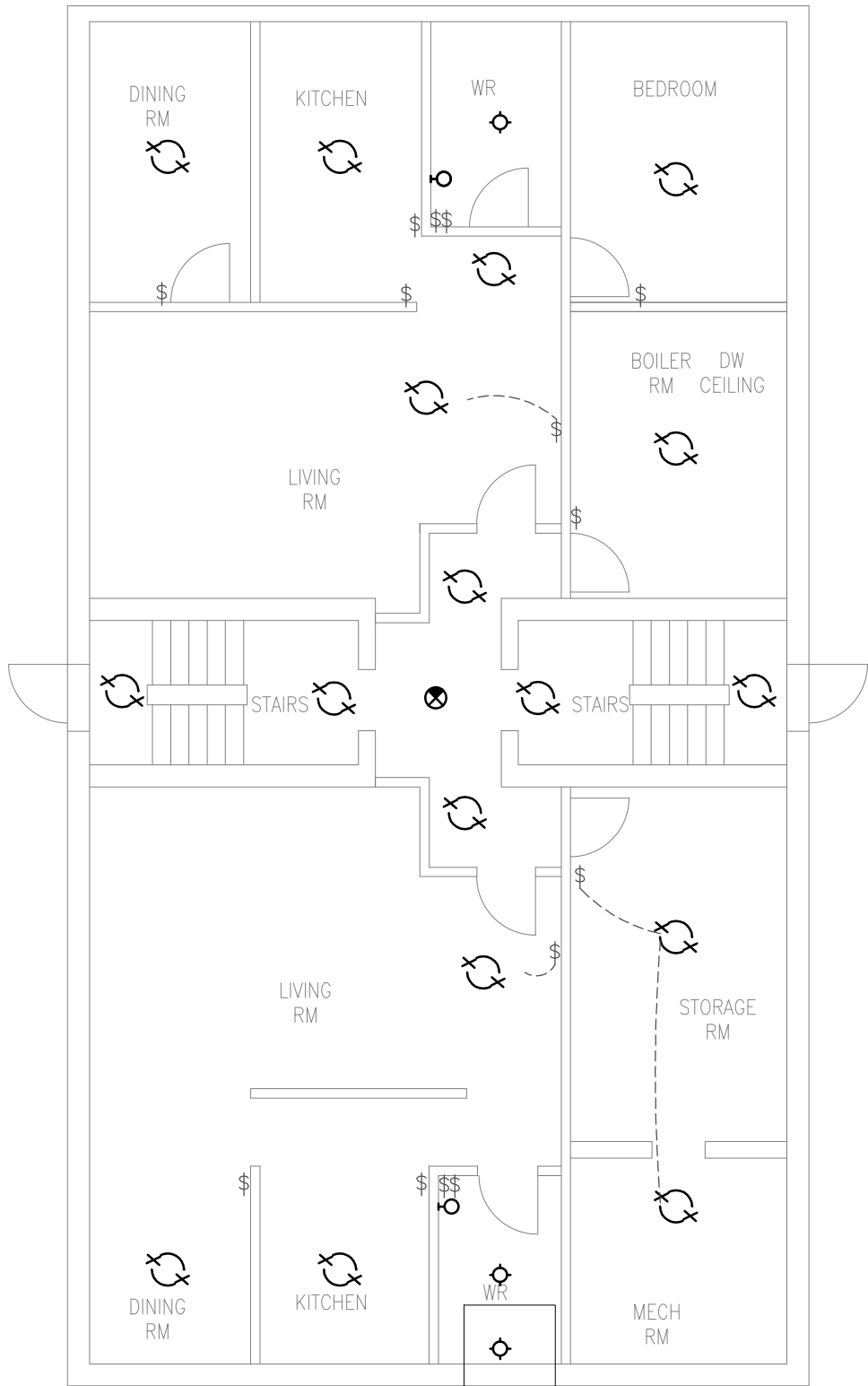
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FILE NO: PBE-25-03	
DATE: MAY 2025 SCALE: AS NOTED DRAWN BY: IE CHECKED BY: MSK	



SF



GF

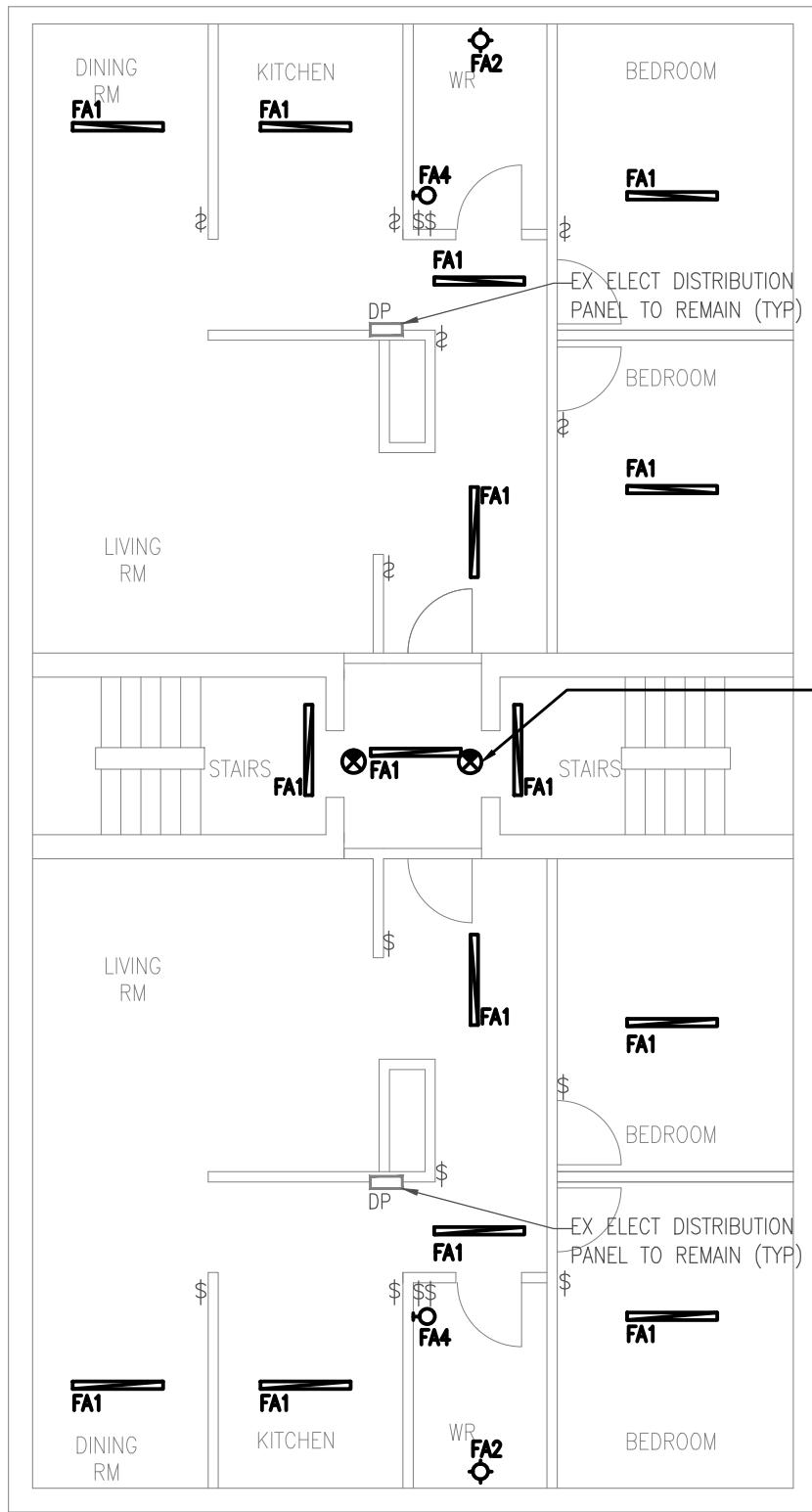


BASEMENT

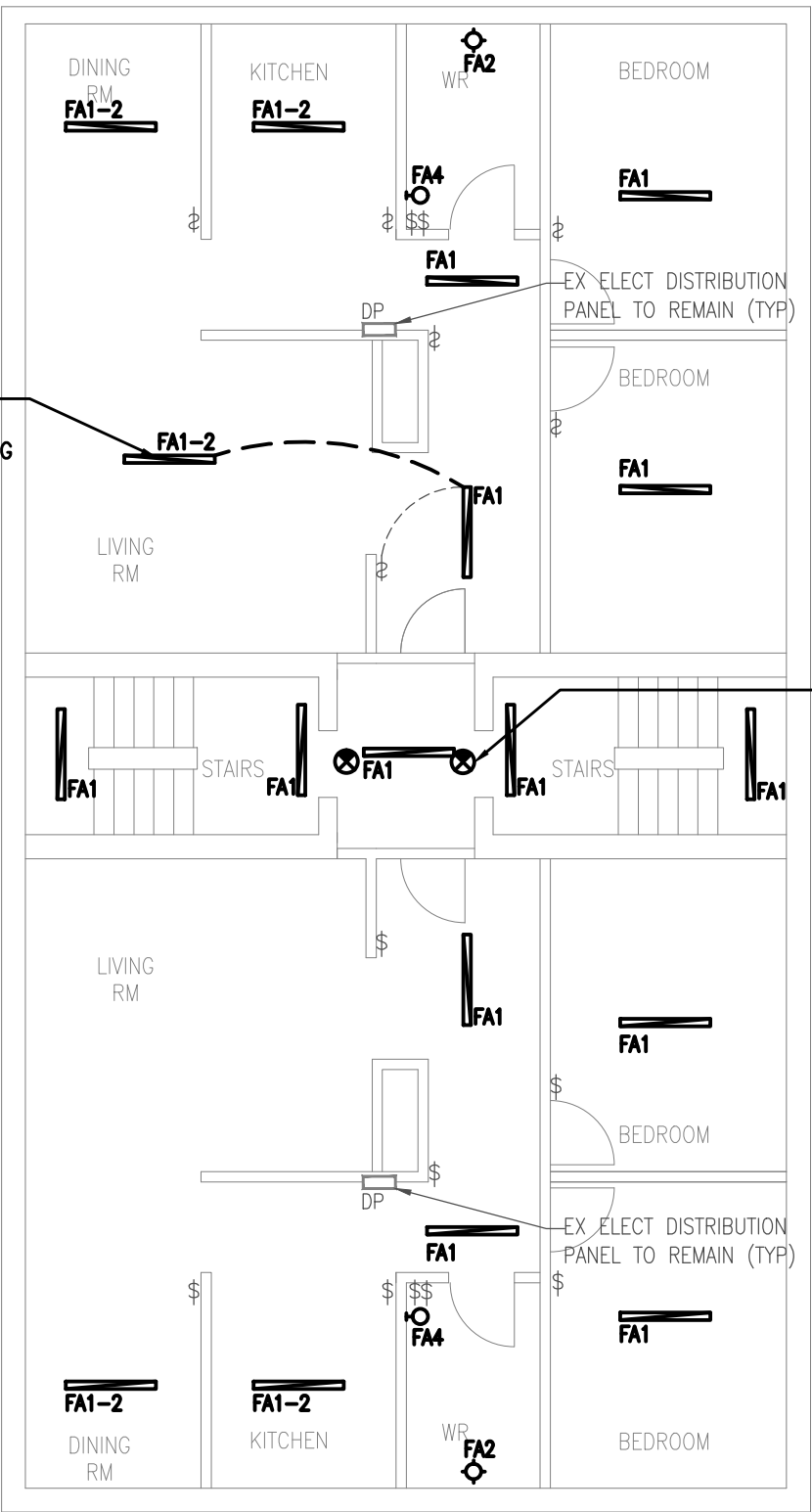
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DRYWALL CEILING
ALL LF FIXTURES
ARE TO BE SURFACE
MTD.

DEMO PLAN

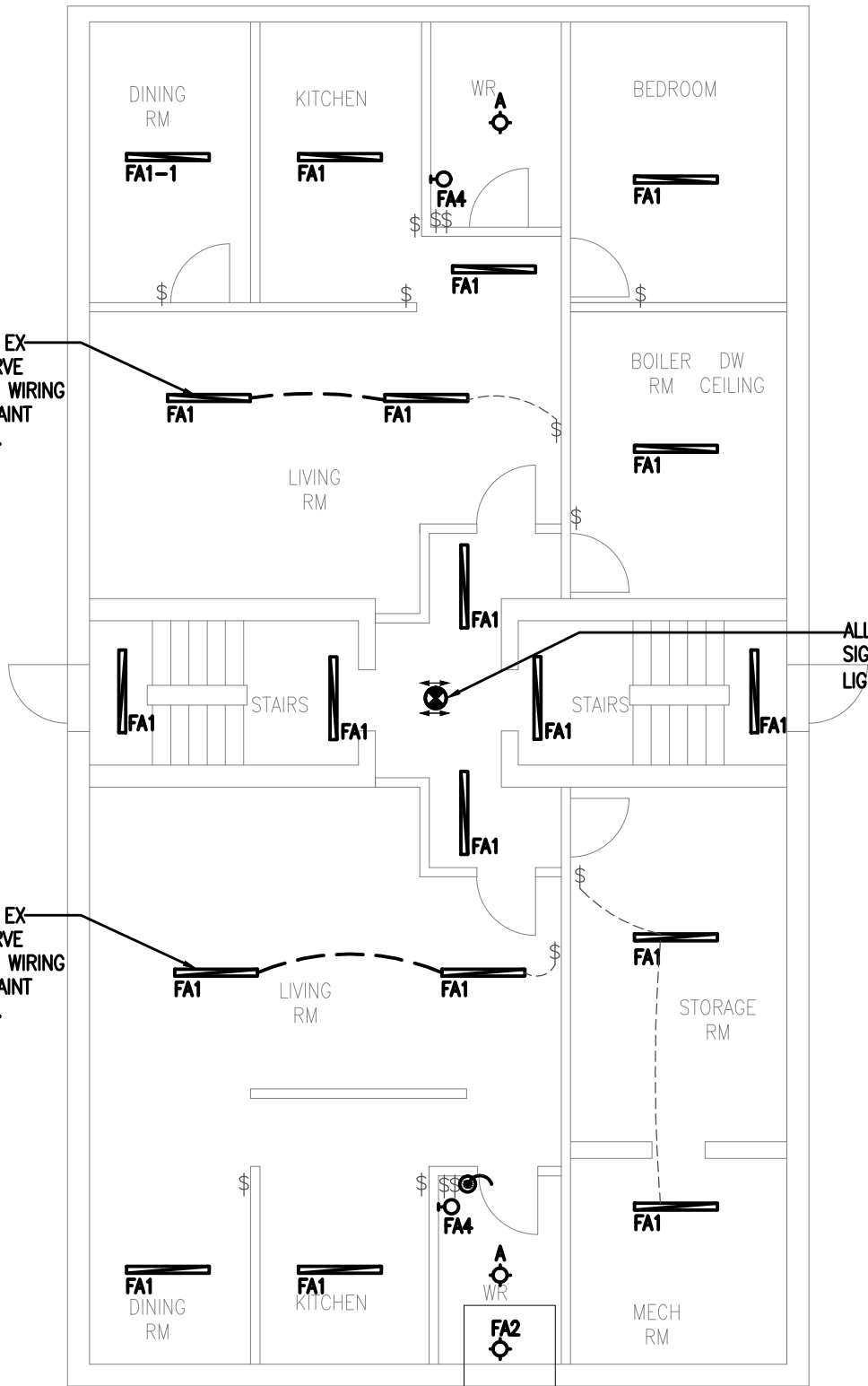
SCALE: 1/8" = 1'-0"



SF



GF



BASEMENT

ALL NEW EMERGENCY EXIT
SIGNS TO HAVE EMERGENCY
LIGHTS ATTACHED (TYP)

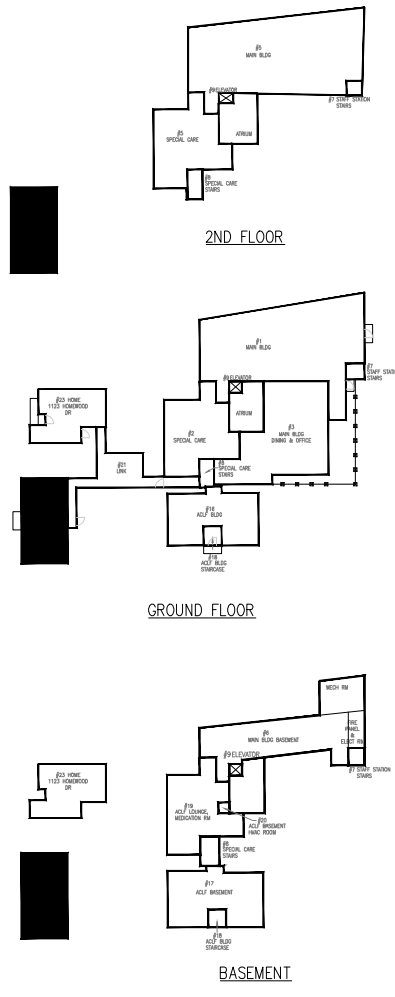
ALL SPACES ARE
DRYWALL CEILING
ALL LF FIXTURES
ARE TO BE SURFACE
MTD.

ALL NEW EMERGENCY EXIT
SIGNS TO HAVE EMERGENCY
LIGHTS ATTACHED (TYP)

ALL NEW EMERGENCY EXIT
SIGNS TO HAVE EMERGENCY
LIGHTS ATTACHED (TYP)

NEW PLAN

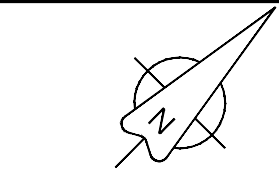
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PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:

#22 APT
1119 HOMEWOOD DR

ELECT PLAN

PROJECT NO:

MK-2025-XXX

FILE NO:

PBE-25-03

DATE: MAY 2025

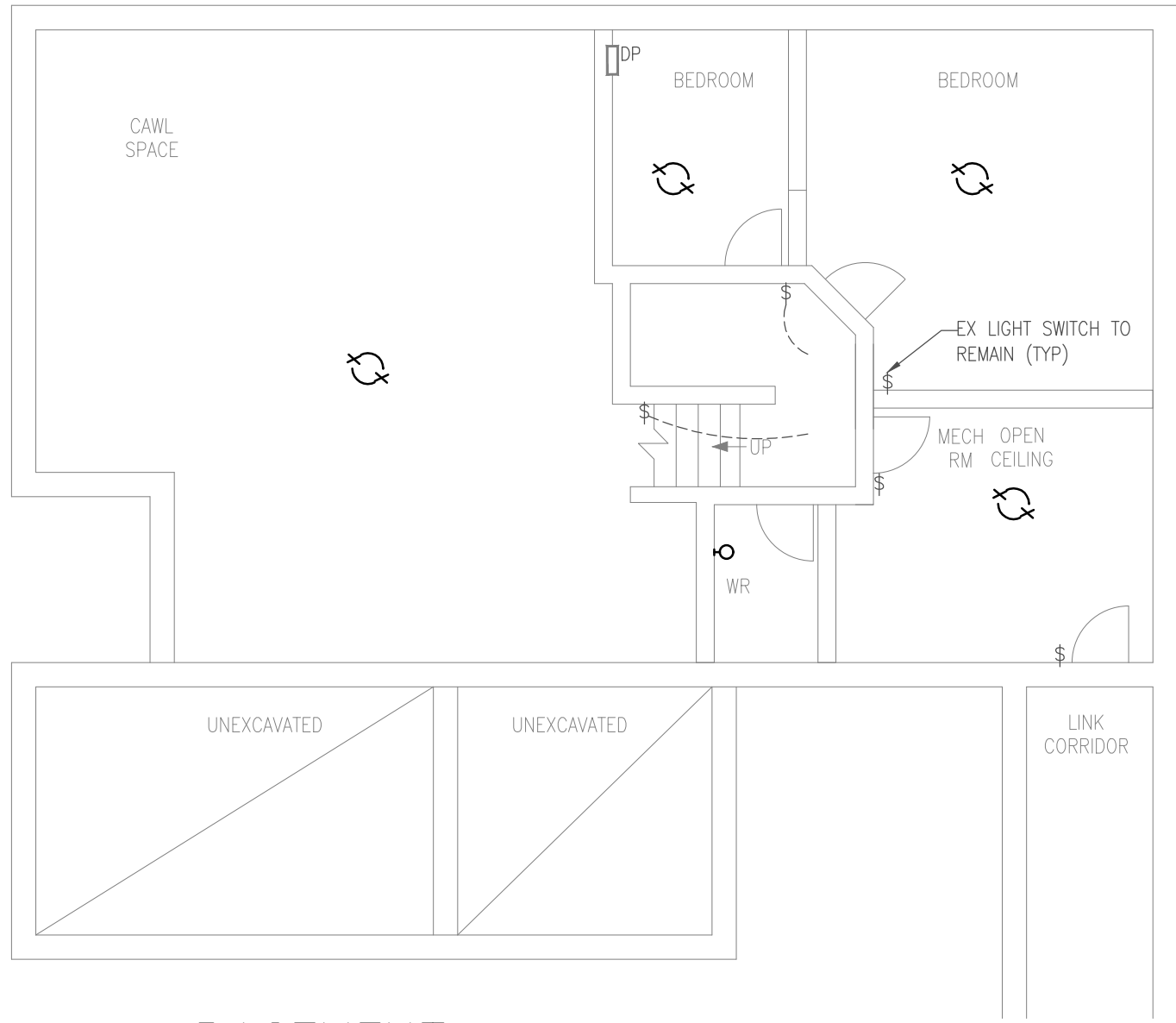
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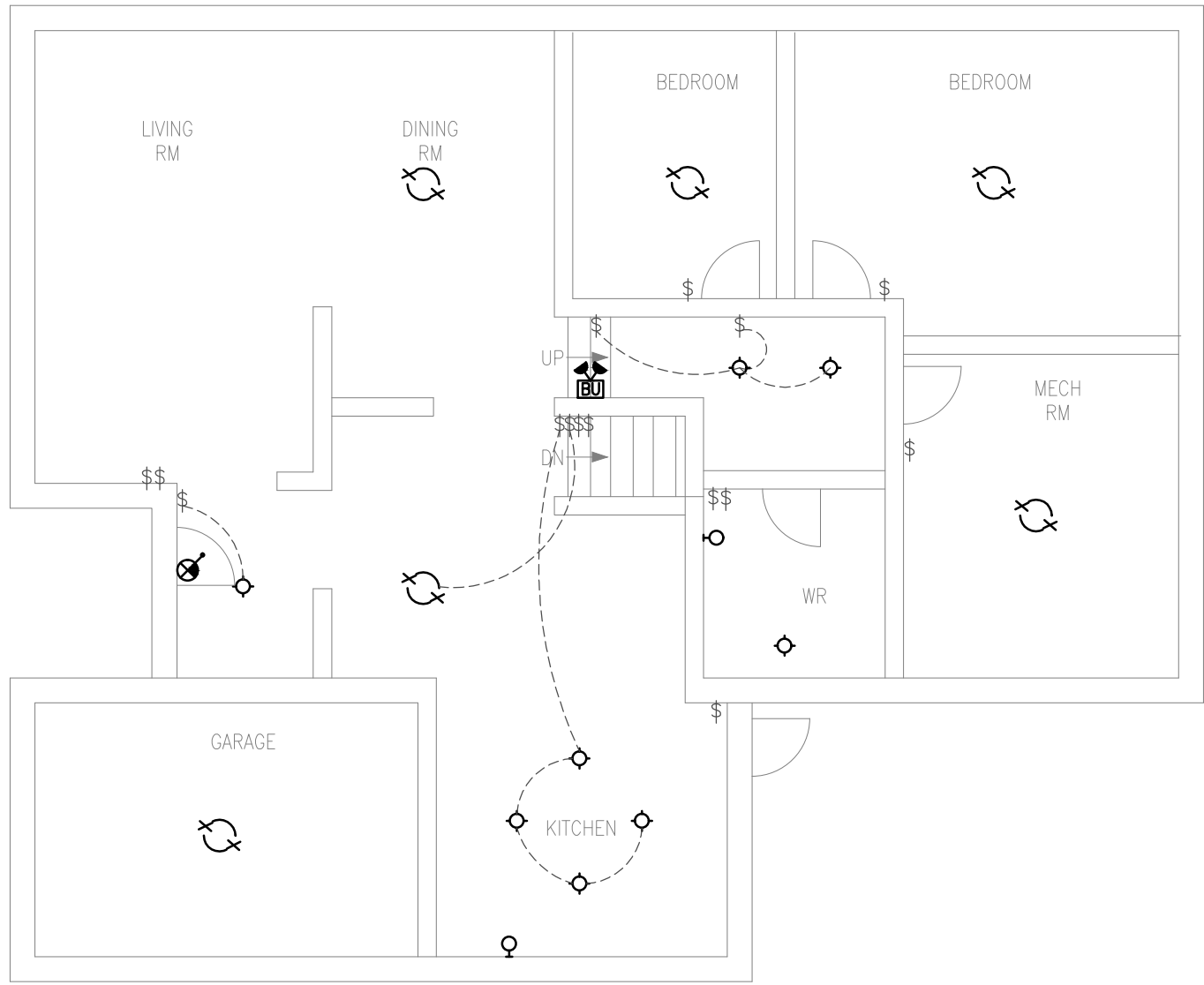
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DRAWING NO:

E10



BASEMENT

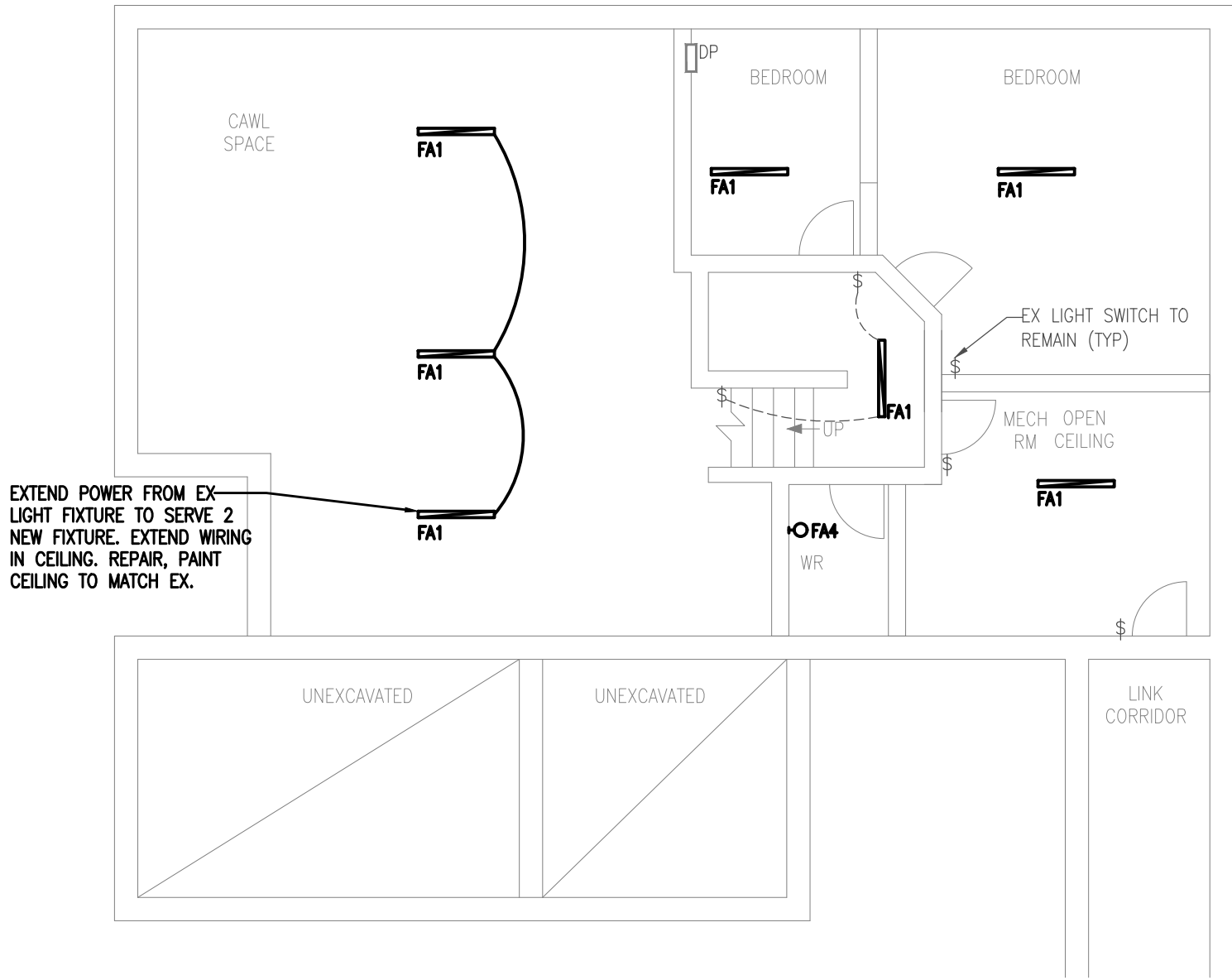


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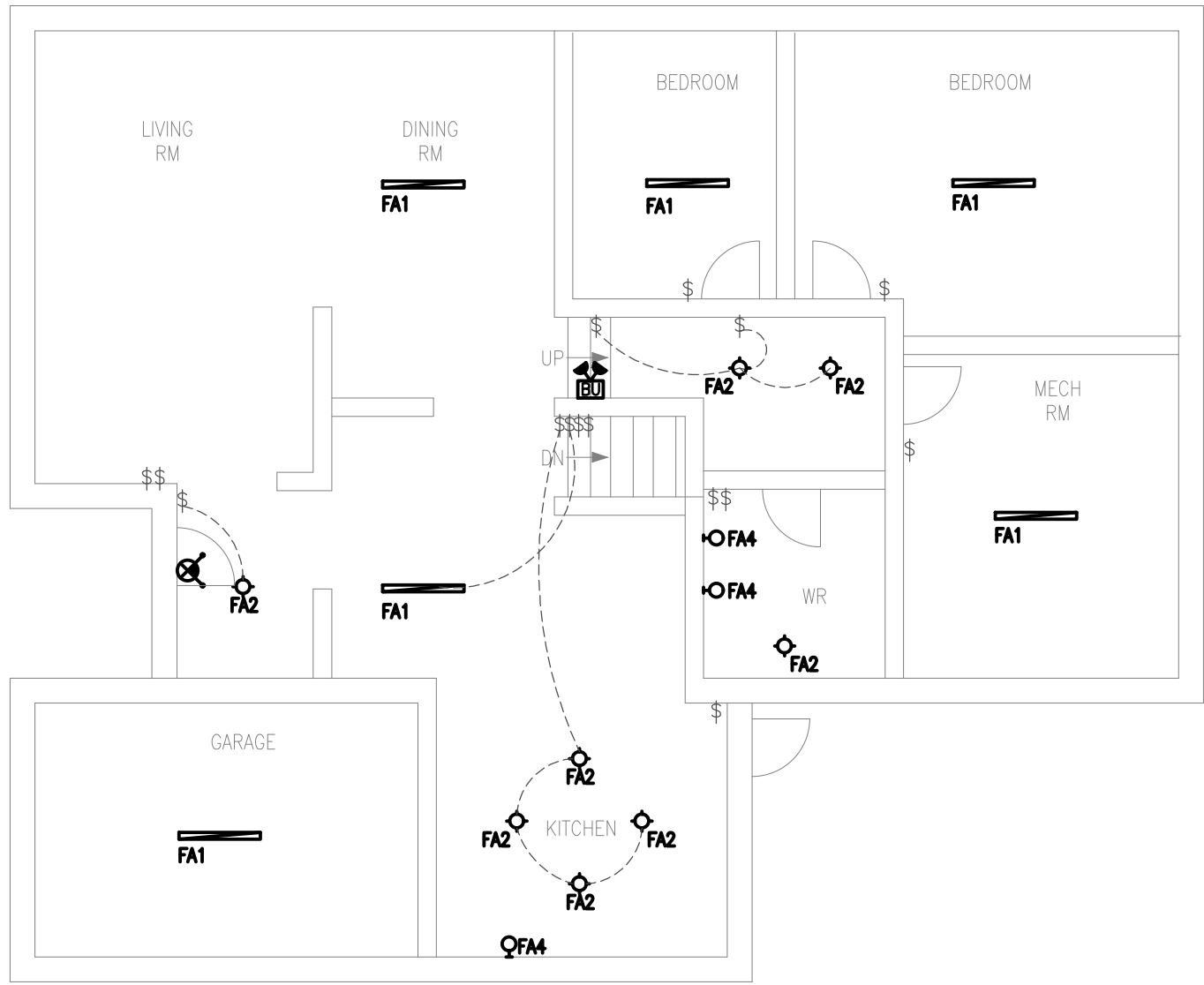
ALL SPACES ARE
DRYWALL CEILING
ALL LF FIXTURES
ARE TO BE SURFACE
MTD.

DEMO PLAN

SCALE: 1/8" = 1'-0"



BASEMENT

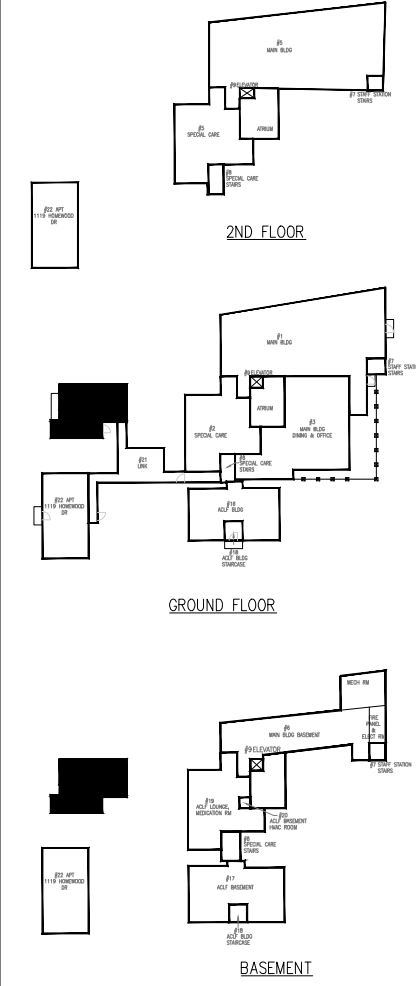


GROUND FLOOR

ALL SPACES ARE
DRYWALL CEILING
ALL LF FIXTURES
ARE TO BE SURFACE
MTD.

NEW PLAN

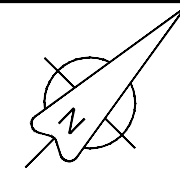
SCALE: 1/8" = 1'-0"



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BETHANY RESIDENCE
2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:

#23 APT
1123 HOMEWOOD DR

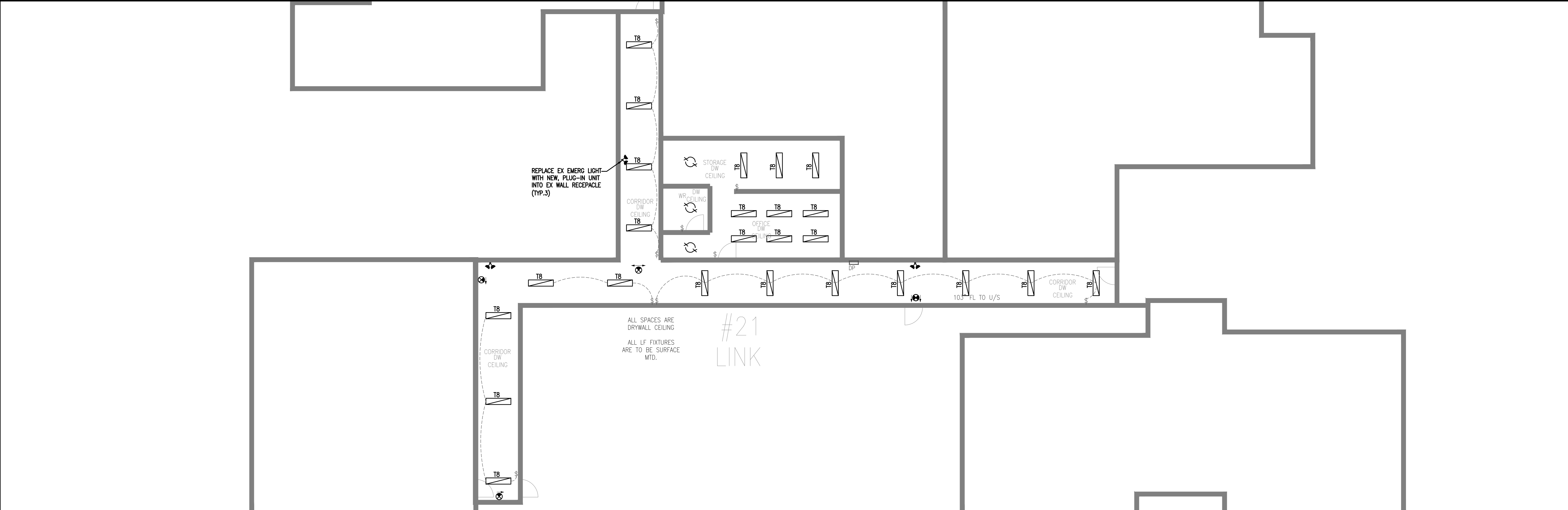
ELECT PLAN

PROJECT NO:
MK-2025-XXX

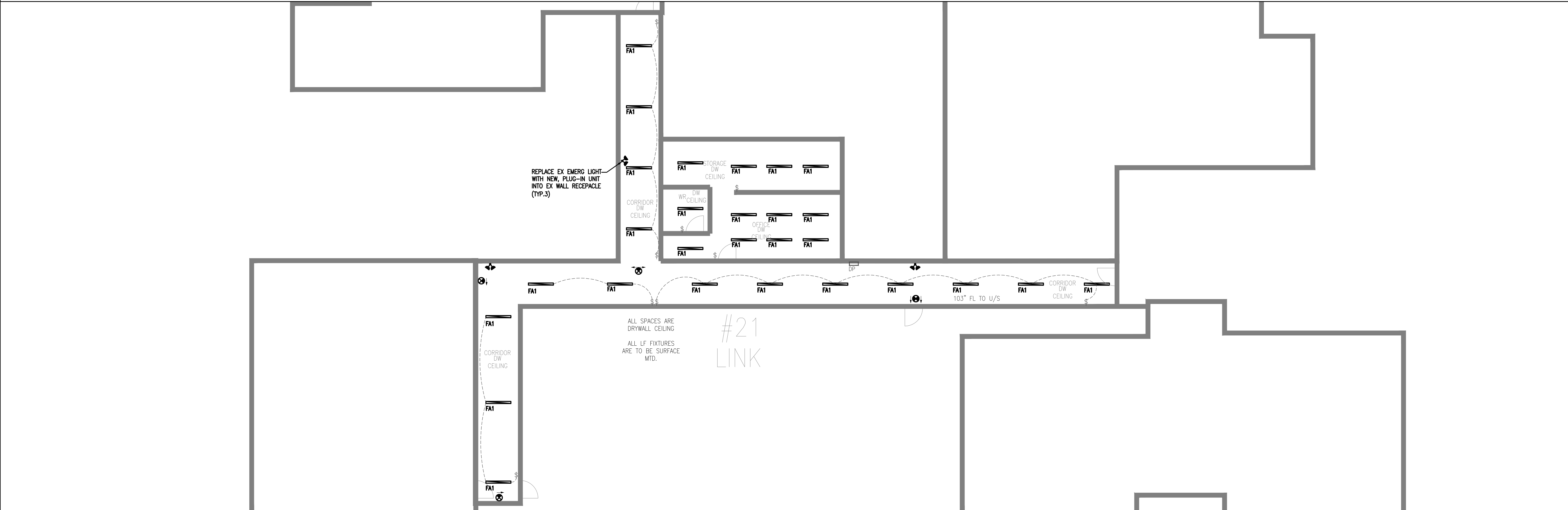
FILE NO:
PBE-25-03

DATE: MAY 2025
SCALE: AS NOTED
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CHECKED BY: MSK

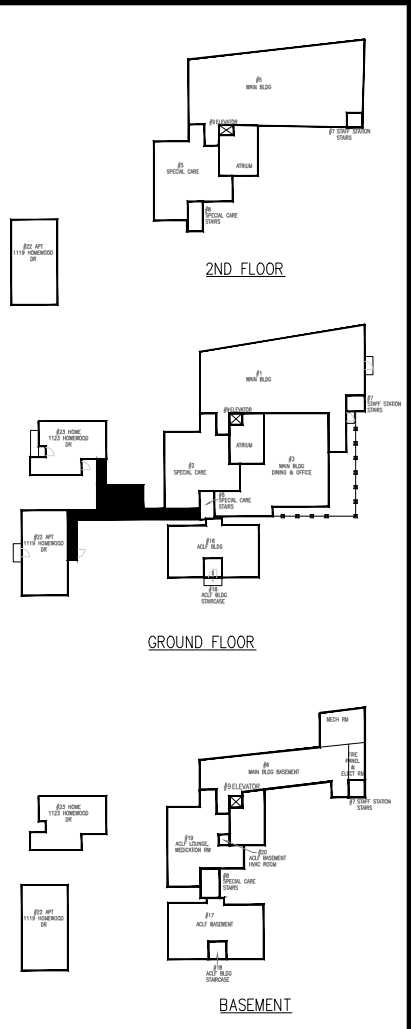
DRAWING NO:
E11



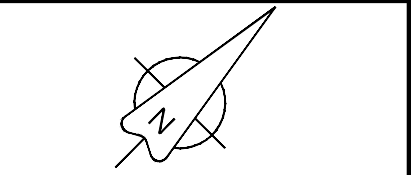
DEMO PLAN
SCALE: 1/8" = 1'-0"



NEW PLAN
SCALE: 1/8" = 1'-0"



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REV.	DATE	NAME	DESCRIPTION



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PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE

2387 INDUSTRIAL ST.
BURLINGTON ON

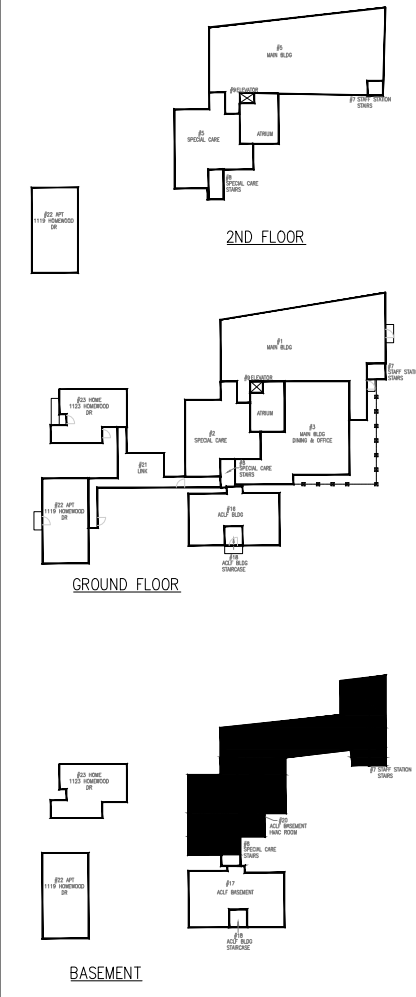
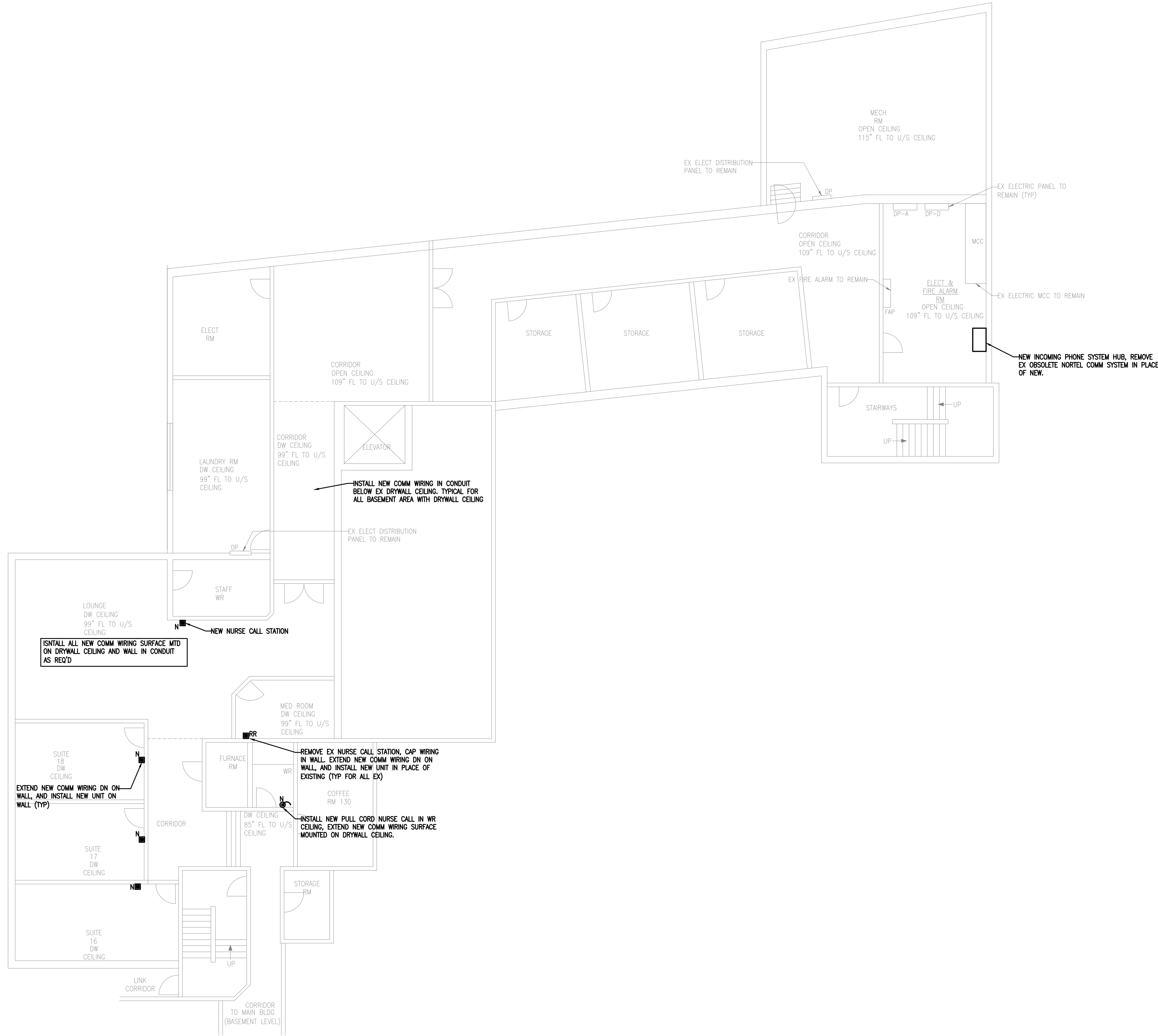
DRAWING TITLE:
#21 LINK
(GF CORRIDOR)

ELECT PLAN

PROJECT NO:
MK-2025-XXX

FILE NO:
PBE-25-03

DATE: MAY 2025	DRAWING NO:
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GENERAL NOTES:

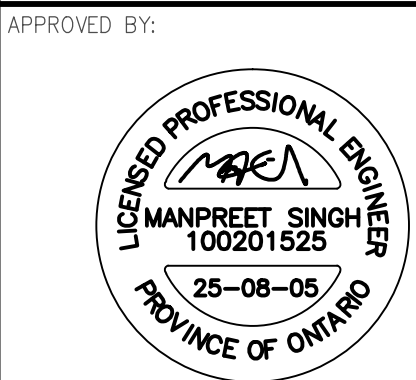
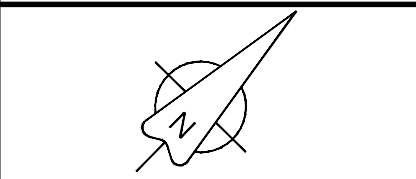
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REV.	DATE	NAME	DESCRIPTION

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PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE

2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:

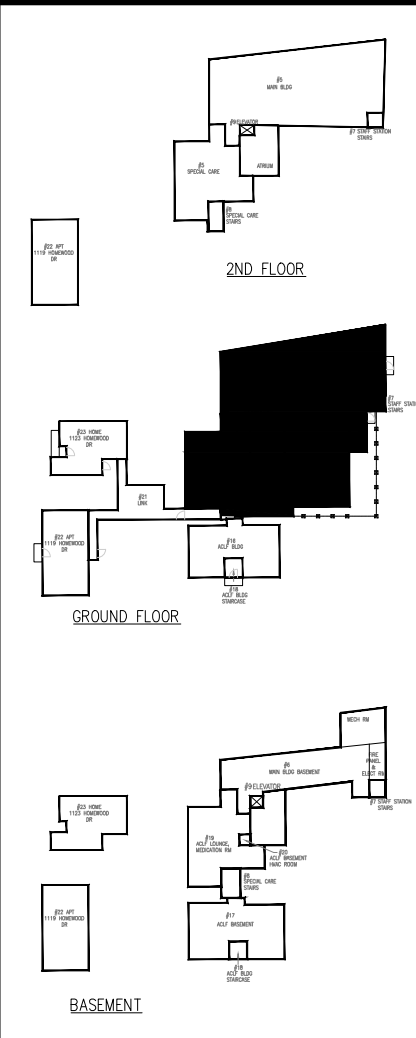
MAIN BUILDING
BASEMENT
ELECT COMM PLAN

PROJECT NO: MK-2025-03

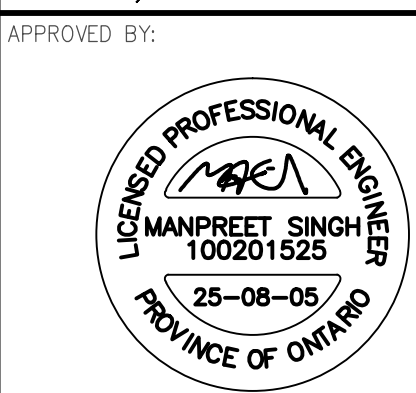
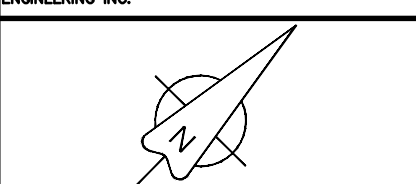
FILE NO: PBE-25-03

DATE: MAY 2025
SCALE: AS NOTED
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DRAWING NO: EC2



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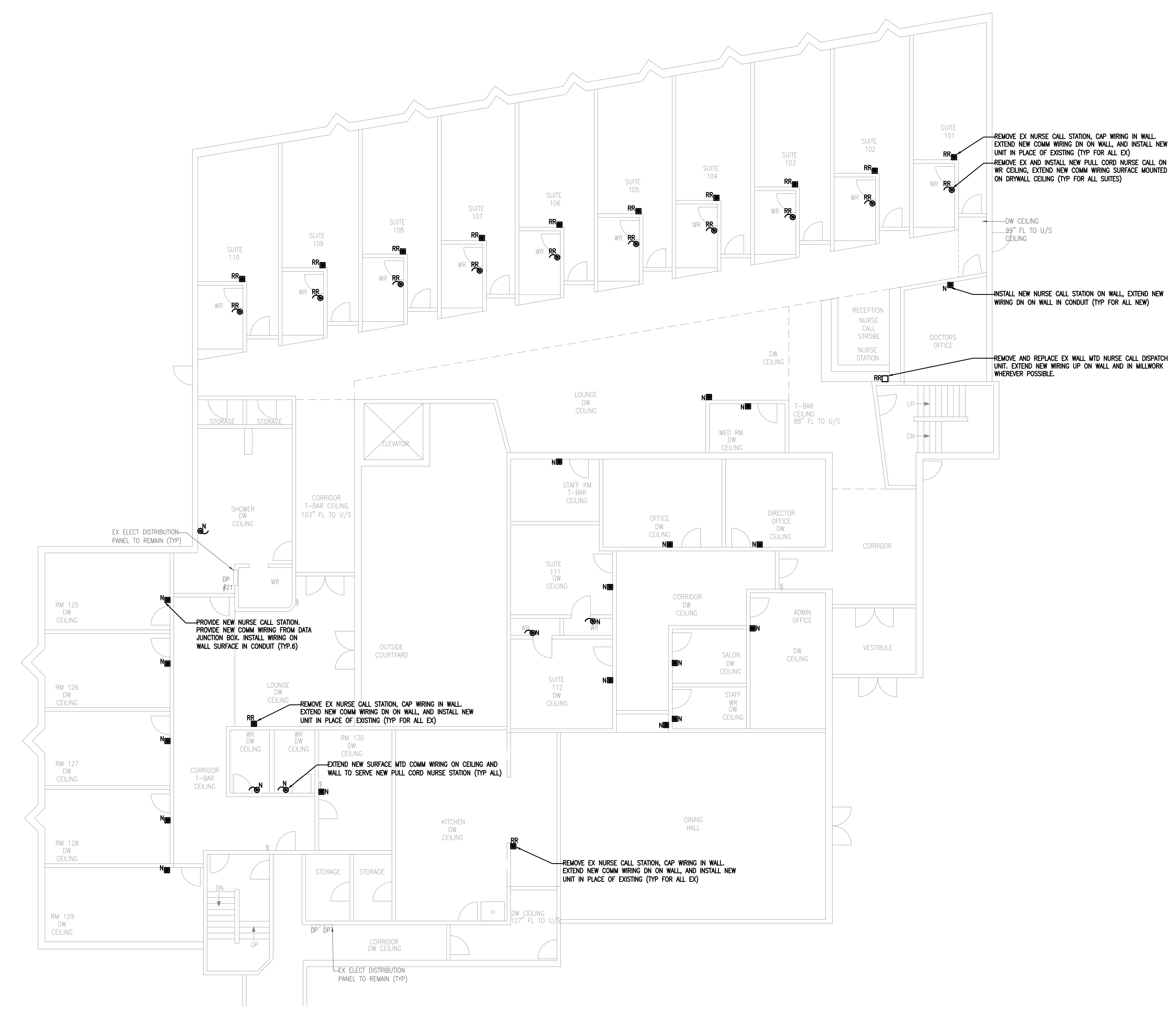
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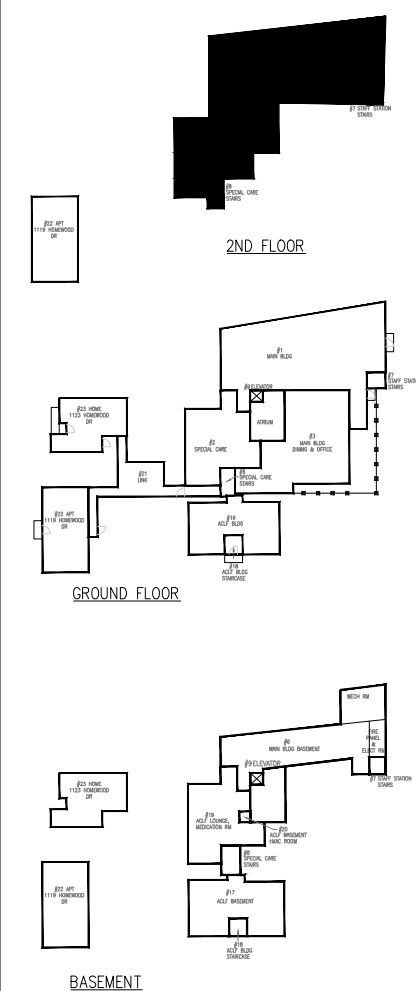
BUILDING UPGRADES
BETHANY RESIDENCE

2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:
MAIN BUILDING GF
ELECT COMM PLAN

PROJECT NO.:
MK-2025-03
FILE NO.:
PBE-25-03
DATE: MAY 2025
SCALE: AS NOTED
DRAWN BY: IE
CHECKED BY: MSK
DRAWING NO.:
EC3





GENERAL NOTES

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2021	2022	2023	2024
2025	2026	2027	2028
2029	2030	2031	2032
2033	2034	2035	2036
2037	2038	2039	2040
2041	2042	2043	2044
2045	2046	2047	2048
2049	2050	2051	2052

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01	MAR.26.26	MK	ISSUED FOR TENDER

REV.	
CLIENT	

CONSULTANT:



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Toronto ON M1R 4M5, Canada
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www.ProBuildEngineering.ca
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PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
2387 INDUSTRIAL ST
BURLINGTON ON

DRAWING TITLE:

MAIN BUILDING SF

ELECT COMM PLAN

PROJECT NO: MK-2025-03

FILE NO: PBE-25-03

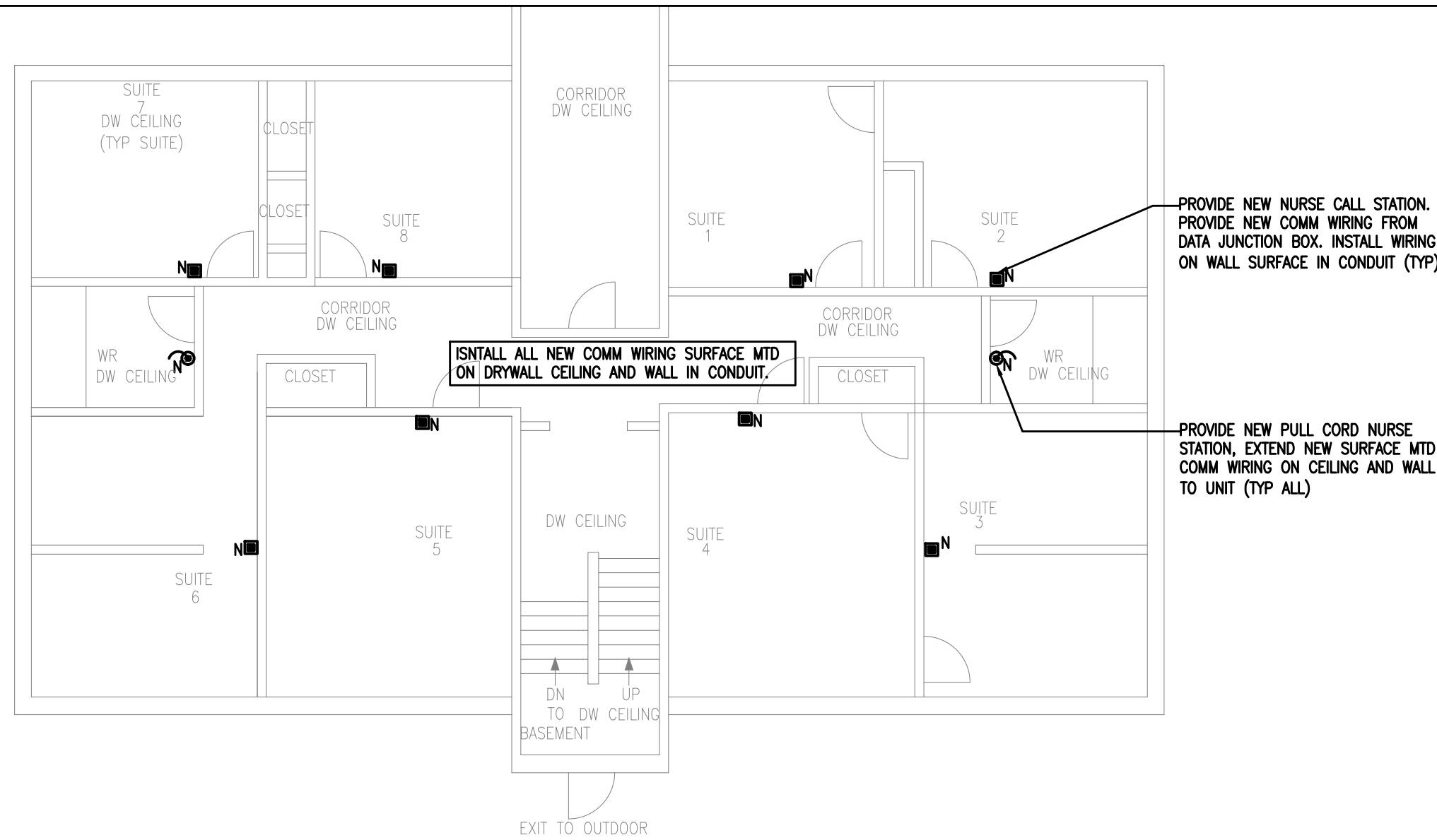
DATE: MAY 2025

SCALE: AS NOTED

DRAWN BY:	IE
CHECKED BY:	MSK

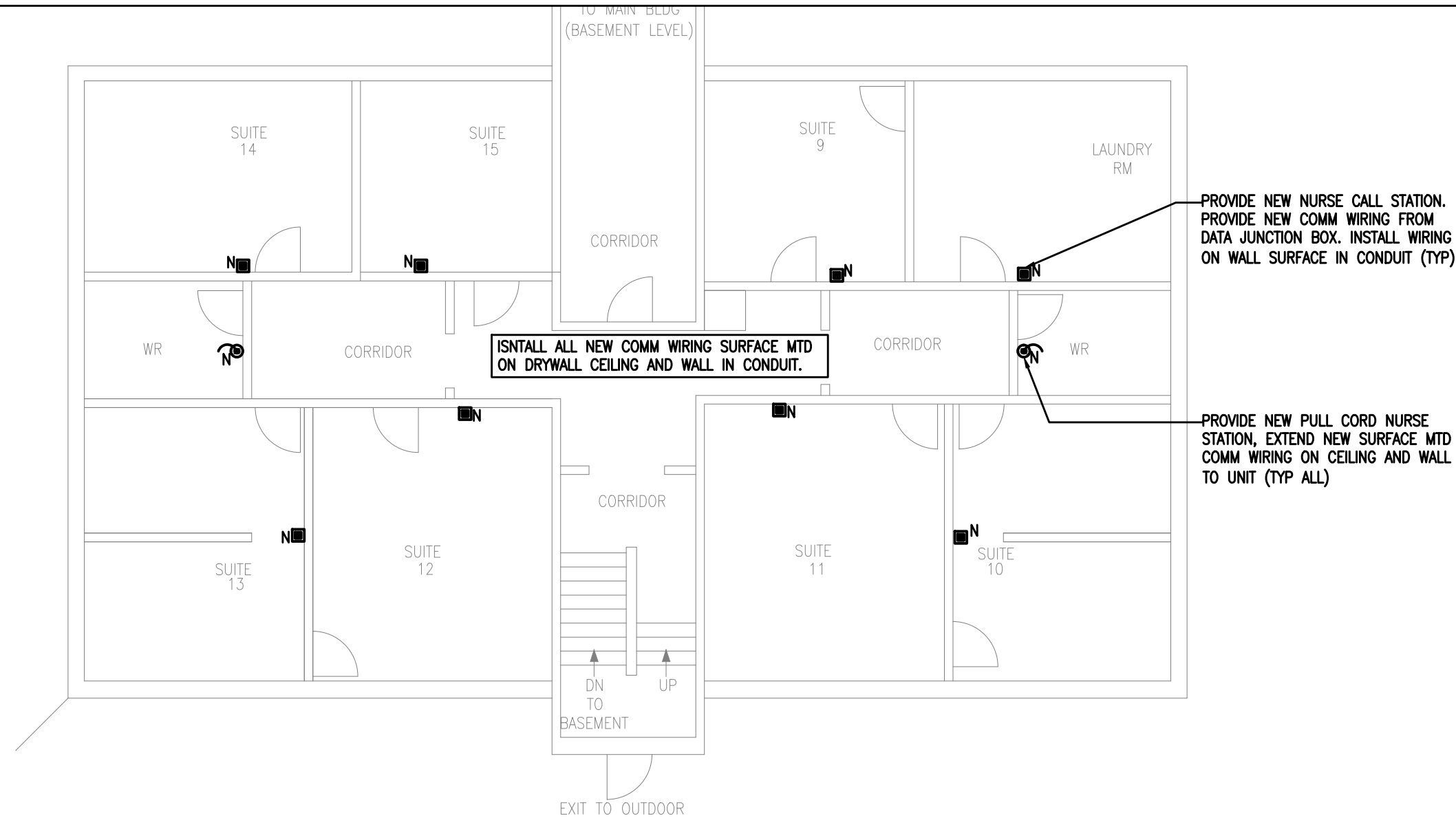
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EC4



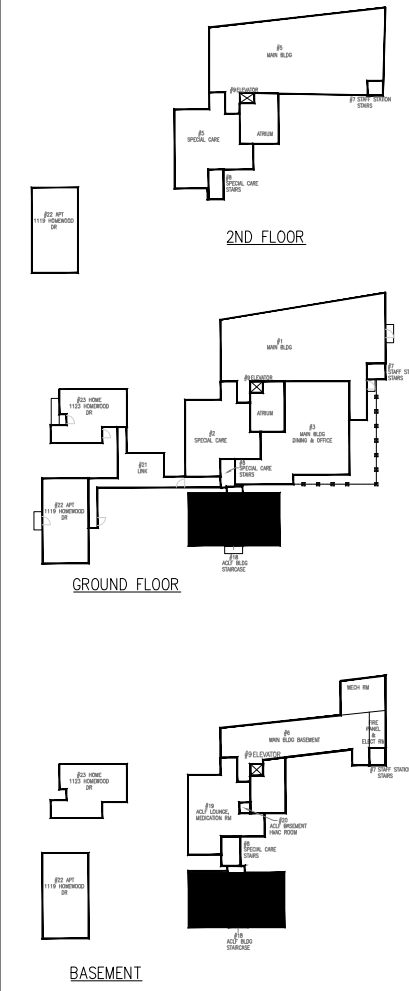
FIRST FL NEW PLAN

SCALE: 1/8" = 1'-0"



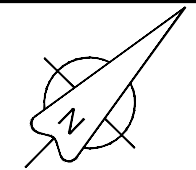
BASEMENT FL NEW PLAN

SCALE: 1/8" = 1'-0"



GENERAL NOTES:

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02	MAR.26.26	MK	ISSUED FOR TENDER
01	NOV.27.25	MK	ISSUED FOR TENDER

REV.	DATE	NAME	DESCRIPTION

CLIENT:

CONSULTANT:



50 Shandon Dr.,
Toronto ON M1R 4M5, Canada
Tel: (416) 671-0054
www.ProbuildEngineering.ca
info@ProbuildEngineering.ca

PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:

ACLF BLDG
ELECT COMM PLAN

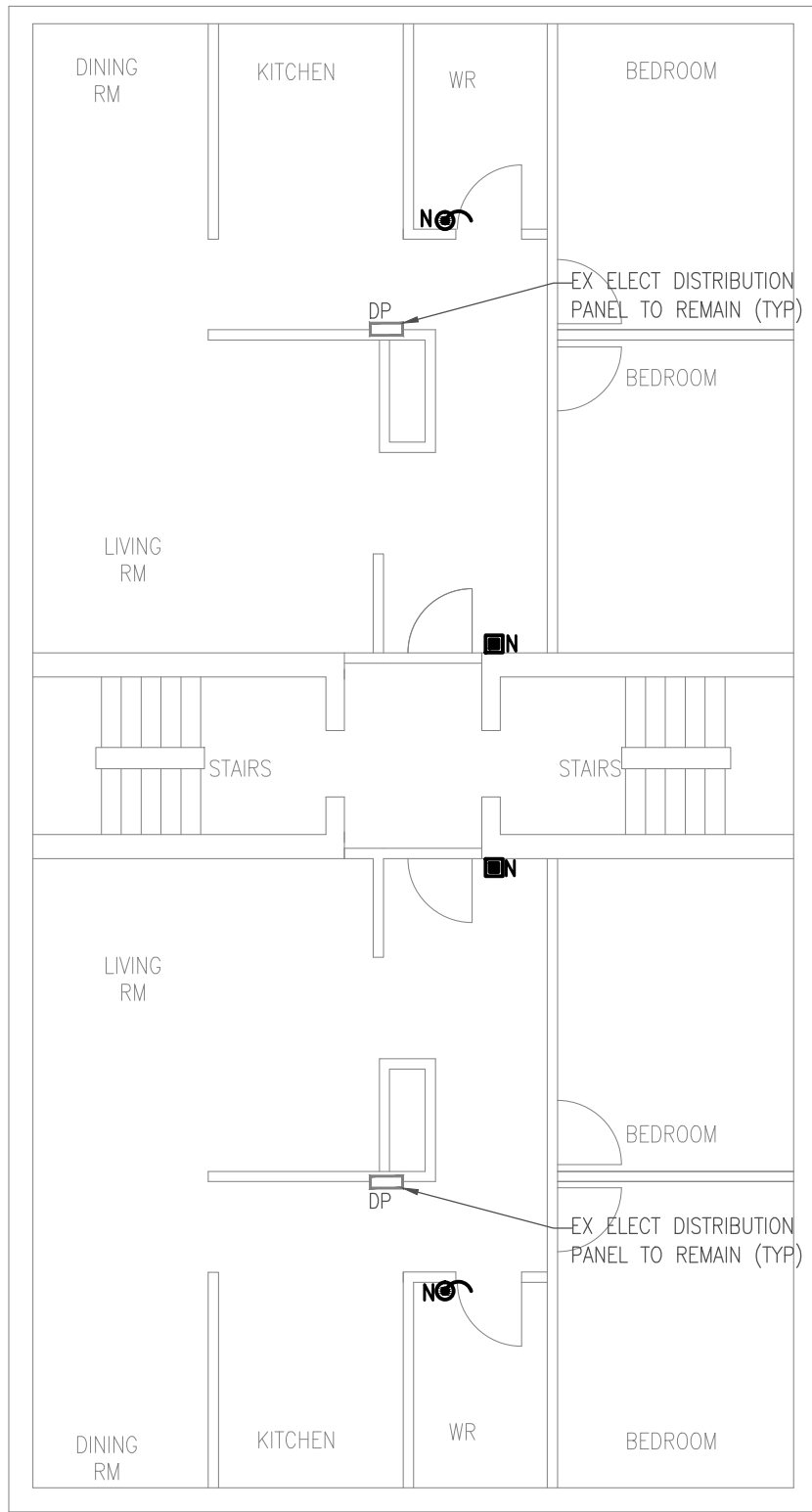
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MK-2025-03

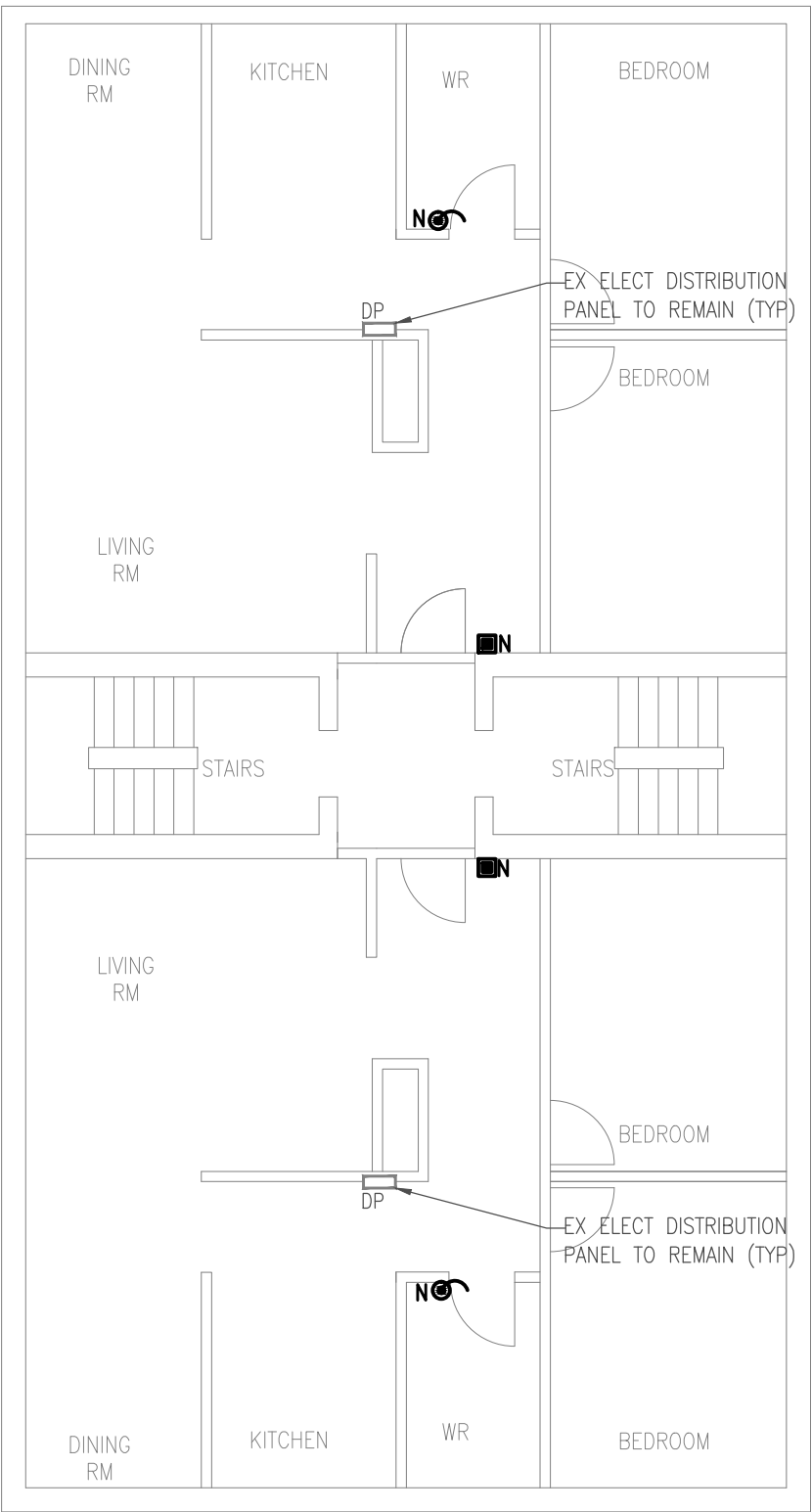
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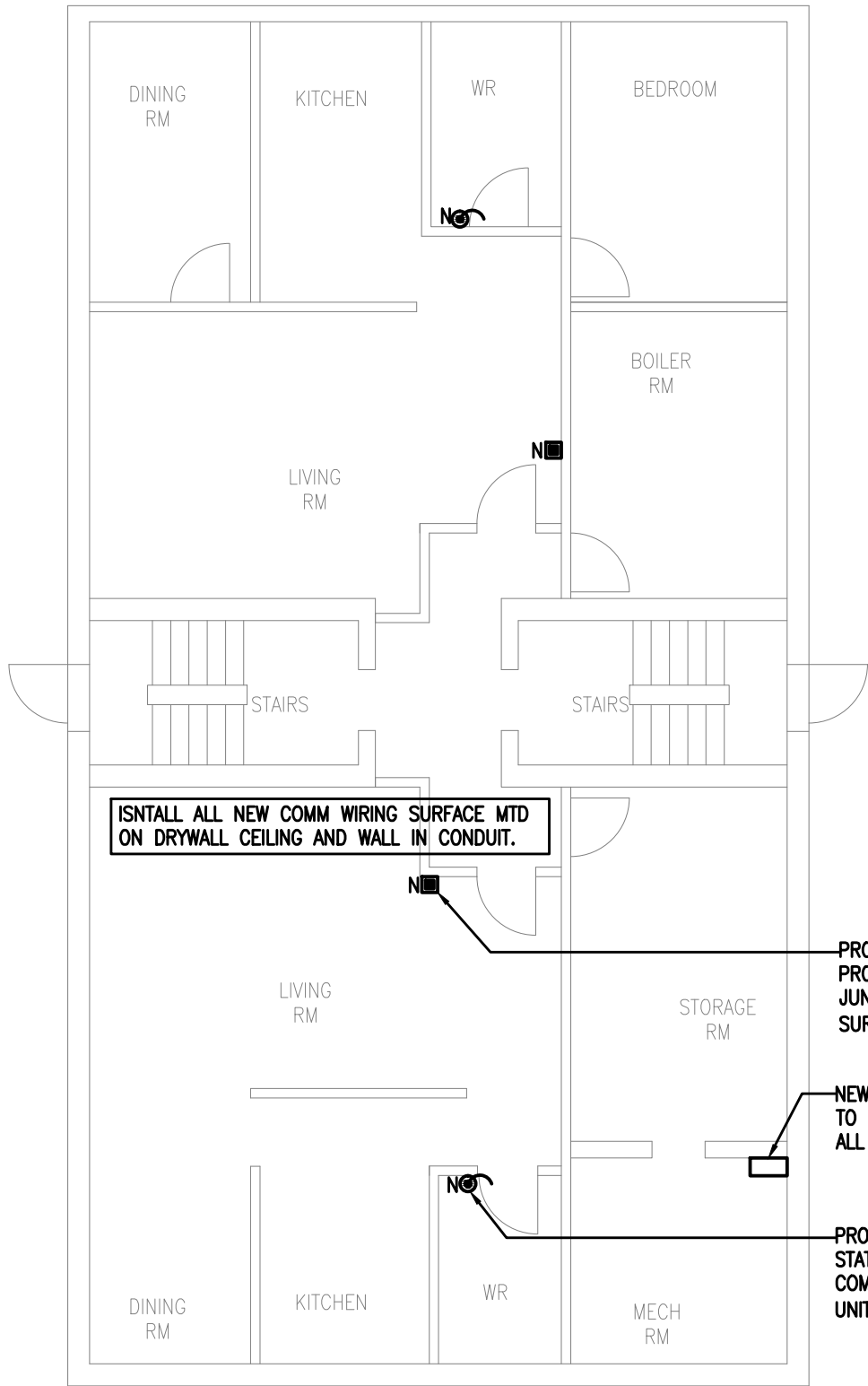
DATE: MAY 2025	DRAWING NO:
SCALE: AS NOTED	EC5
DRAWN BY: IE	
CHECKED BY: MSK	



SF



GF



BASEMENT

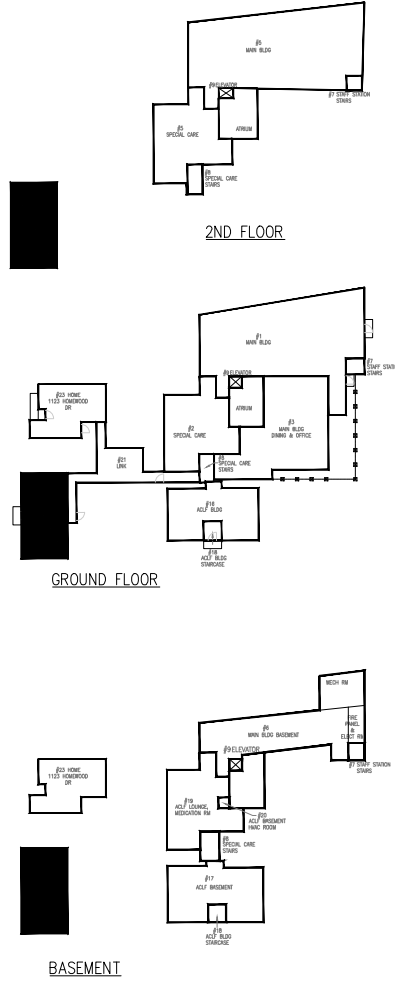
PROVIDE NEW NURSE CALL STATION.
PROVIDE NEW COMM WIRING FROM DATA
JUNCTION BOX. INSTALL WIRING ON WALL
SURFACE IN CONDUIT (TYP)

NEW JUNCTION BOX, EXTEND ALL WIRING
TO NURSE CALL STATION FROM HERE TO
ALL UNITS.

PROVIDE NEW PULL CORD NURSE
STATION, EXTEND NEW SURFACE MTD
COMM WIRING ON CEILING AND WALL TO
UNIT (TYP ALL)

NEW PLAN

SCALE: 1/8" = 1'-0"



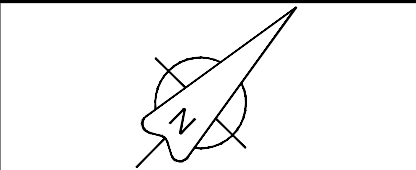
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01	NOV.27.25	MSK	ISSUED FOR TENDER

CLIENT:

CONSULTANT:

PROBUILD ENGINEERING

50 Shandon Dr.,
Toronto ON M1R 4M5, Canada
Tel: (416) 671-0054
www.ProbuildEngineering.ca
info@ProbuildEngineering.ca

PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE

2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:

#22 APT
1119 HOMEWOOD DR

ELECT COMM PLAN

PROJECT NO:
MK-2025-03

FILE NO:
PBE-25-03

DATE: MAY 2025

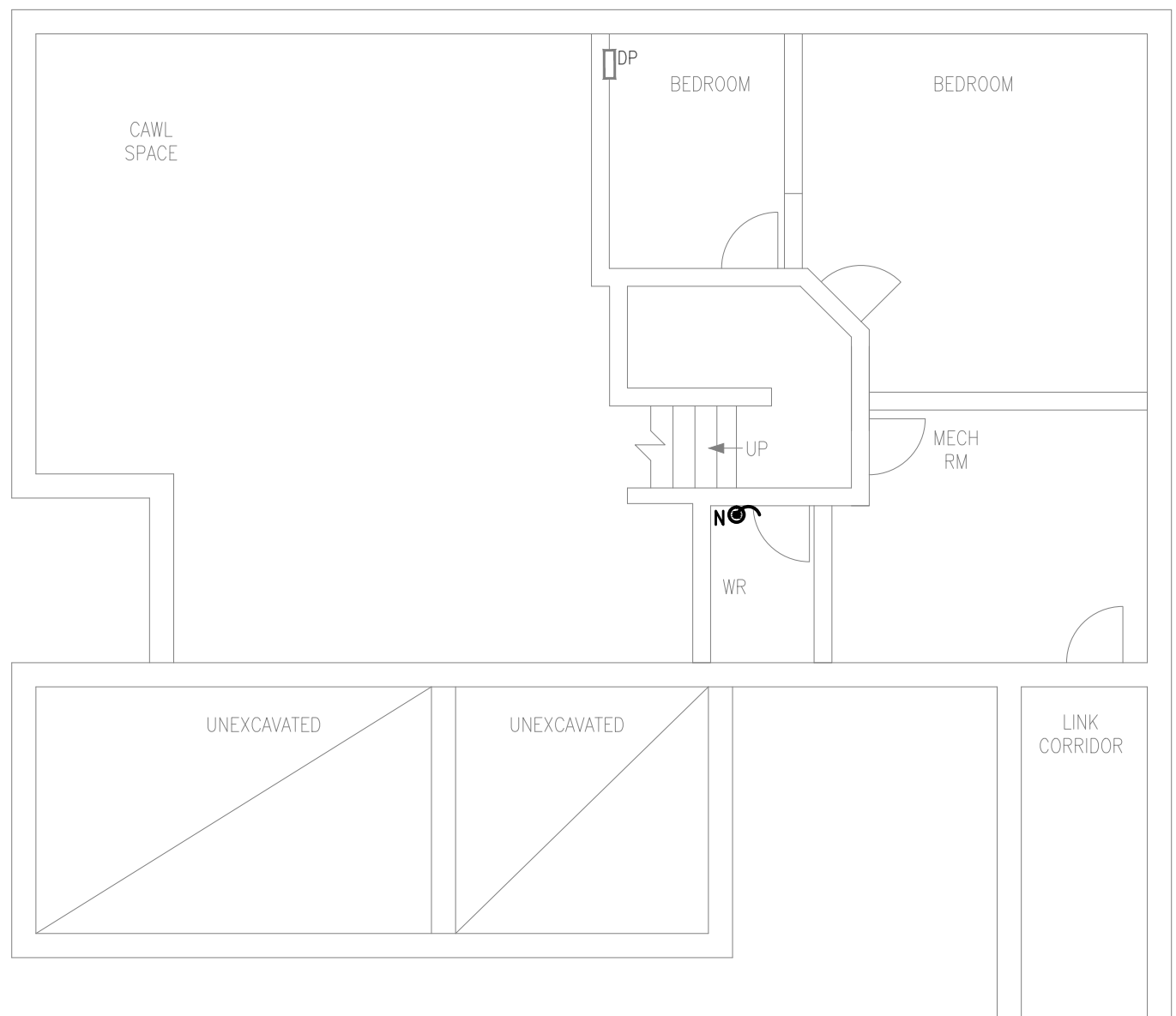
SCALE: AS NOTED

DRAWN BY: IE

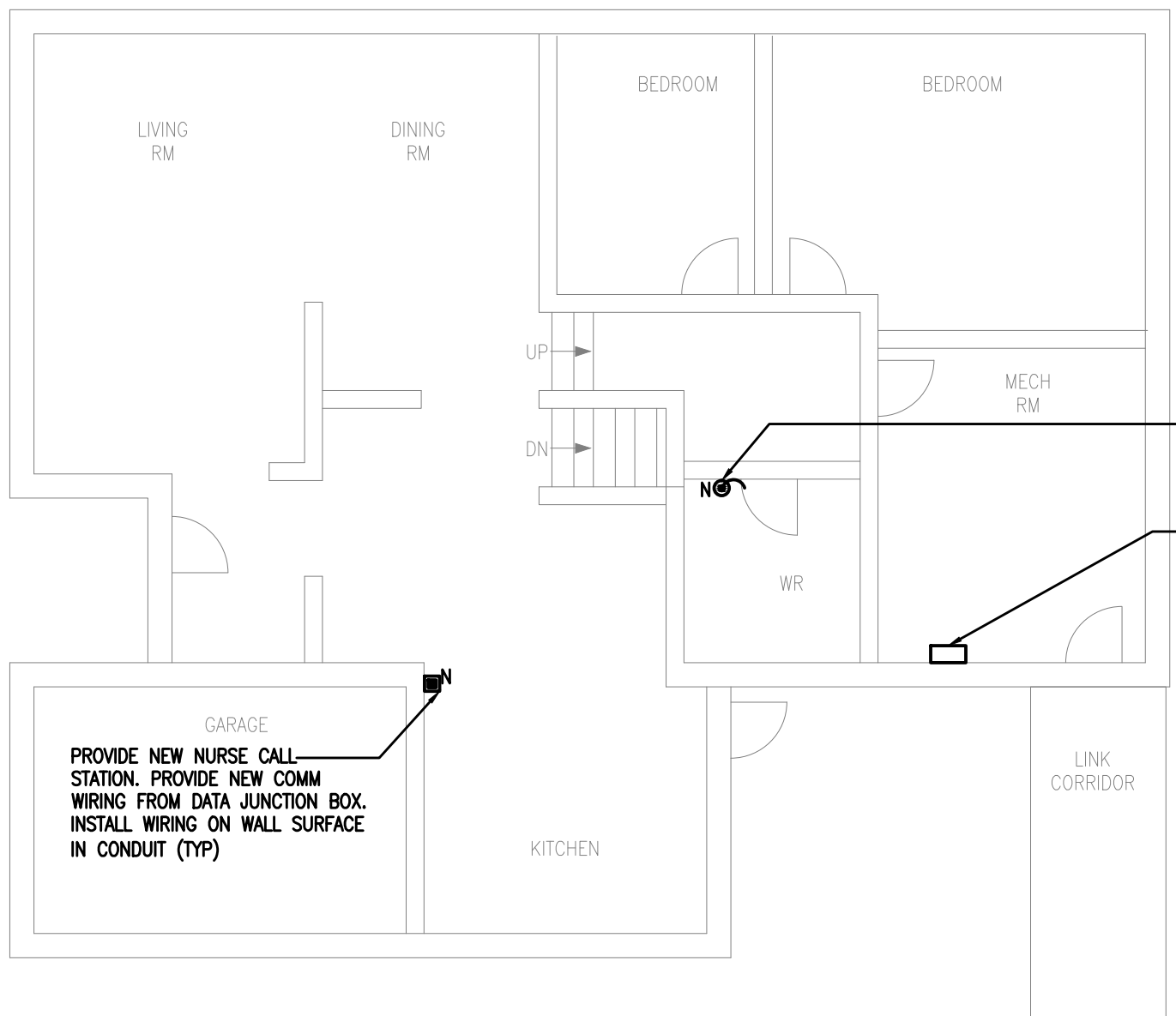
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DRAWING NO:

EC6

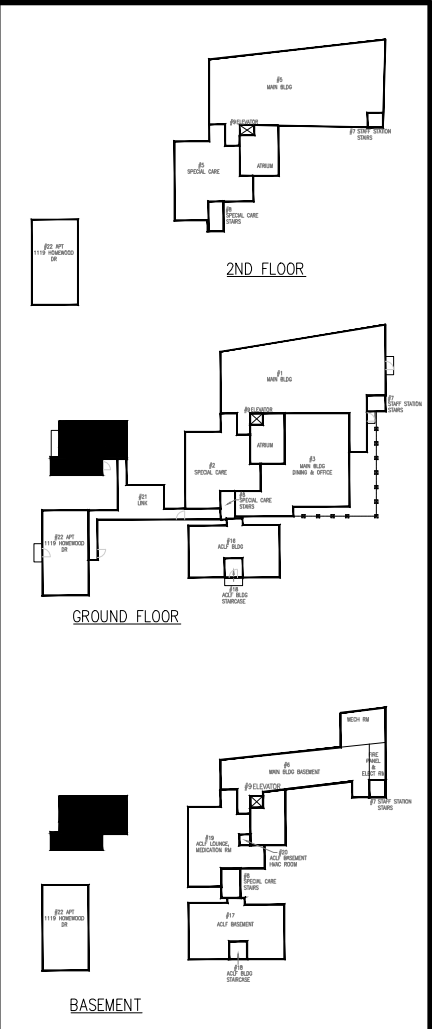


BASEMENT

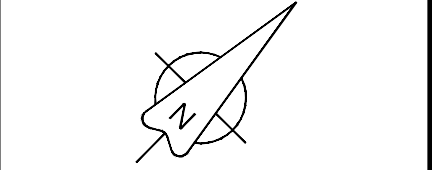


GROUND FLOOR

NEW PLAN
SCALE: 1/8" = 1'-0"



GENERAL NOTES:
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01	NOV.27.25	MK	ISSUED FOR TENDER

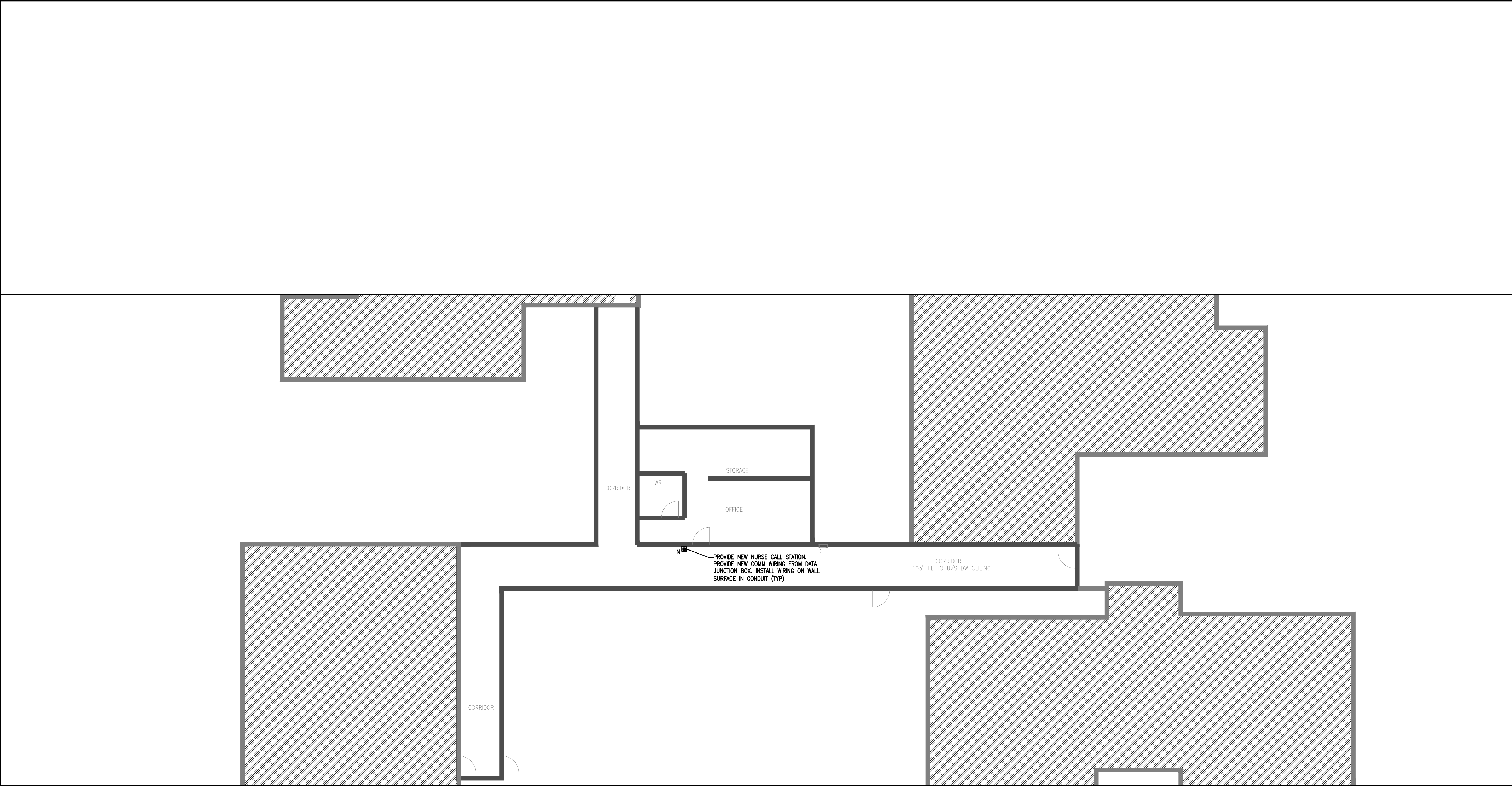
CLIENT:

CONSULTANT:
PROBUILD ENGINEERING
50 Shandon Dr.,
Toronto ON M1R 4M5, Canada
Tel: (416) 671-0054
www.ProBuildEngineering.ca
info@ProBuildEngineering.ca

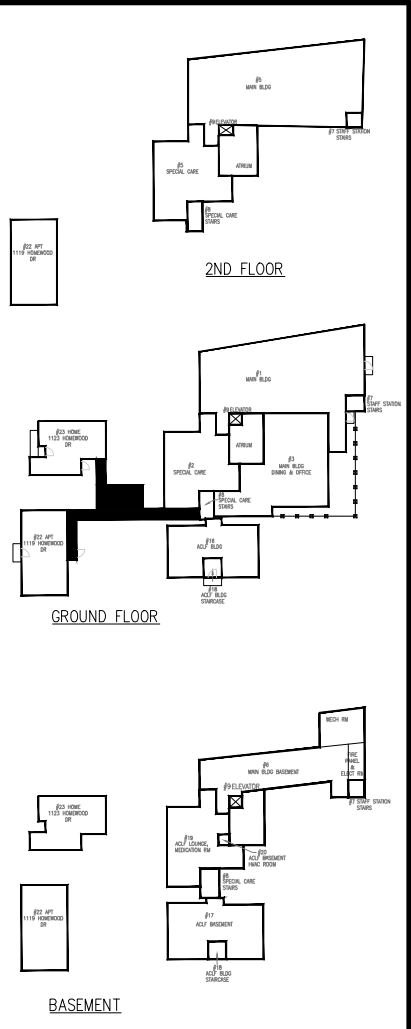
PROJECT NAME:
BUILDING UPGRADES
BETHANY RESIDENCE
2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:
#23 APT
1123 HOMEWOOD DR
ELECT COMM PLAN

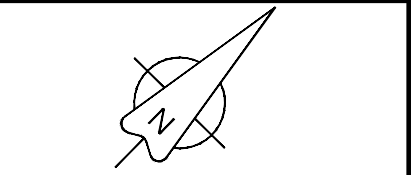
PROJECT NO:
MK-2025-03
FILE NO:
PBE-25-03
DATE: MAY 2025
SCALE: AS NOTED
DRAWN BY: IE
CHECKED BY: MSK
DRAWING NO:
EC7



NEW PLAN
SCALE: 1/8" = 1'-0"



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01	NOV.27.25	MK	ISSUED FOR TENDER

REV.	DATE	NAME	DESCRIPTION

CLIENT:

CONSULTANT:

PROBUILD ENGINEERING

50 Shandon Dr.,
Toronto ON M1R 4M5, Canada
Tel: (416) 671-0054
www.ProBuildEngineering.ca
info@ProBuildEngineering.ca

PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE

2387 INDUSTRIAL ST.
BURLINGTON ON

DRAWING TITLE:

#21: LINK
(GF CORRIDOR)

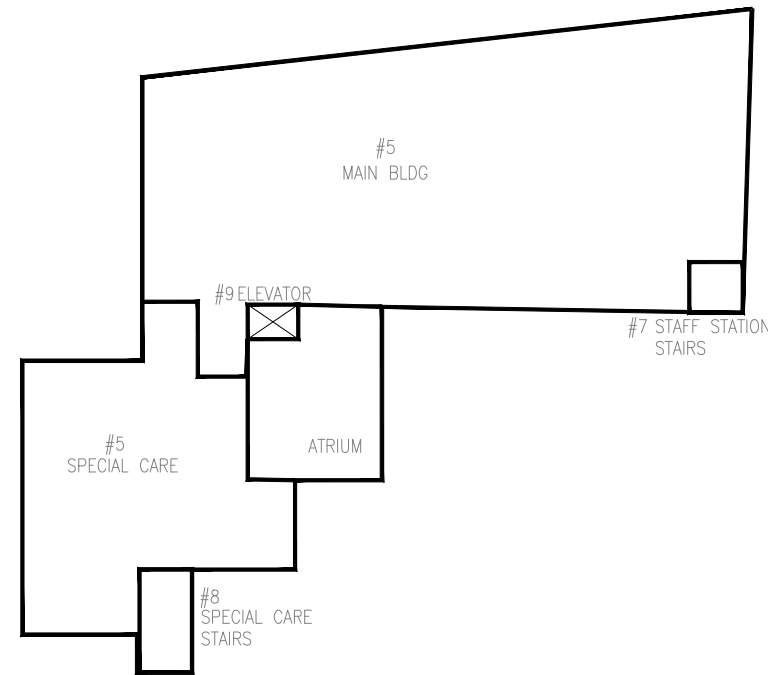
ELECT COMM PLAN

PROJECT NO:
MK-2025-03

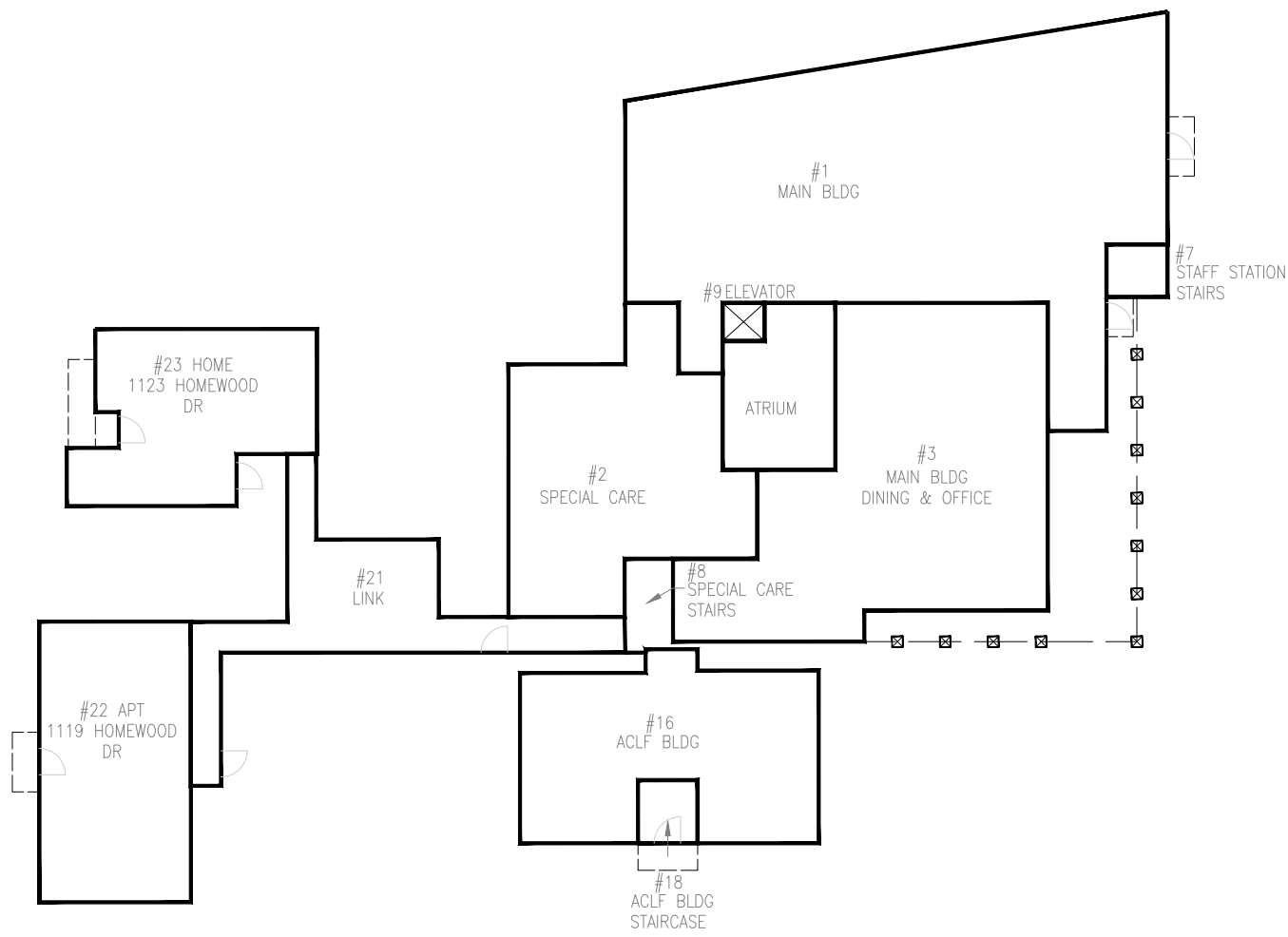
FILE NO:
PBE-25-03

DATE: MAY 2025	DRAWING NO:
SCALE: AS NOTED	EC8
DRAWN BY: IE	
CHECKED BY: MSK	

KEY PLAN



2ND FLOOR



GROUND FLOOR



BASEMENT

HEATING BOILER SCHEDULE

No.	MAKE	MODEL	TYPE	LOCATION	HEATING CAPACITY		MAX WATER FLOW GPM (L/S)	HEAD LOSS FT (M)	HEATING STAGES	EFFICIENCY AFUE (%)	ELECT	WEIGHT (KG)	DIMENSION IN (M)	FLUE VENT #IN (#mm)
					INPUT MBH	OUTPUT MBH								
HB-1	NTI	TFTN285	CONDENSING	MECH RM	285	263	26 (1.64)	14 (4.26)	MODULATING	95%	120/1/60 12A	82	869Hx467Dx543W	75# CPVC
HB-2	NTI	TFTN285	CONDENSING	MECH RM	285	263	26 (1.64)	14 (4.26)	MODULATING	95%	120/1/60 12A	82	869Hx467Dx543W	75# CPVC

- NOTE:
- WALL MOUNTED, COMMERCIAL BOILER, WIFI ENABLED, STAINLESS STEEL HEAT EXCHANGER, DOWN-FIRED TUBE, WITH BACNET CAPABLE ACCESSORIES, VARIABLE SPEED BOILER PUMP, LEAD LAG OPERATION, LOW NOx, INTERNAL WATER PRESSURE SENSOR, BUILT-IN LOW WATER CUT-OFF WITH TEST BUTTON, 120V CONVENIENCE OUTLET.
 - 4.9 GALLON BOILER WATER CONTENT, 32# WATER CONNECTION, 20# GAS CONNECTION.
 - BOILER CIRCULATING PUMP TO BE GRUNDFOS UPS26-99 RATED FOR 26GPM @ 14 FT OF HEAD.
 - PROVIDE WALL MOUNTING BRACKET.
 - CONNECT BOILERS TO EMERGENCY BACK-UP POWER

PUMP SCHEDULE

PUMP NO.	PUMP NAME	LOCATION	MAKE/MODEL	FLOW GPM (L/S)	HEAD FT (M)	VOLT & PHASE	VFD	MOTOR SIZE HP	RPM	REMARKS
HP-1	HEATING PUMP	MECH ROOM	GRUNDFOS	45 (2.83)	25 (7.62)	115/1/60	YES	1/2	1760	① ② ③ ④ ⑤ ⑧
BP-1	HEATING BOILER PUMP	MECH ROOM	GRUNDFOS UPS26-99	26 (1.64)	14 (4.26)	115/1/60 197W	NO	0.2	1760	⑥ ⑦ ⑧
BP-2	HEATING BOILER PUMP	MECH ROOM	GRUNDFOS UPS26-99	26 (1.64)	14 (4.26)	115/1/60 197W	NO	0.2	1760	⑥ ⑦ ⑧
DP-1	DOM BOILER PUMP	MECH ROOM	GRUNDFOS UPS26-99	26 (1.64)	14 (4.26)	197W	NO	0.2	1760	⑥ ⑦ ⑧

- NOTES:
- LEAD/LAG OPERATION; ONE STAND BY PUMP
 - ALARMS & FAILURE MONITORED BY BAS
 - PROVIDE INTELLIGENT VARIABLE SPEED PUMP WITH SENSOR LESS INTEGRATED CONTROL AND MANUAL OVERRIDE.
 - PUMP SHALL BE PROVIDED WITH PREMIUM EFFICIENT MOTOR SUITABLE FOR VFD USE, VFD FOR BALANCING SYSTEM FLOW.
 - PUMP CONTROLLER TO BE BACNET COMPATIBLE
 - BOILER CIRCULATOR PUMPS, PROVIDED BY BOILER MANUFACTURER, REFER TO BOILER SCHEDULE)
 - BOILER CIRCULATOR PUMPS, CAST IRON, 3 SPEED TECHNOLOGY, CHECK VALVE INCLUDED
 - CONNECT PUMPS TO EMERGENCY POWER

IN-FLOOR HEATING BOILER SCHEDULE

No.	MAKE	MODEL	TYPE	LOCATION	HEATING CAPACITY		MAX WATER FLOW GPM (L/S)	HEAD LOSS FT (M)	HEATING STAGES	EFFICIENCY AFUE (%)	ELECT	WEIGHT (KG)	DIMENSION IN (M)	FLUE VENT #IN (#mm)
					INPUT MBH	OUTPUT MBH								
FHB-1	NTI	TFTN285	CONDENSING	MECH RM	285	263	26 (1.64)	14 (4.26)	MODULATING	95%	120/1/60 12A	82	869Hx467Dx543W	75# CPVC

- NOTE:
- WALL MOUNTED, COMMERCIAL BOILER, WIFI ENABLED, STAINLESS STEEL HEAT EXCHANGER, DOWN-FIRED TUBE, WITH BACNET CAPABLE ACCESSORIES, VARIABLE SPEED BOILER PUMP, LOW NOx, INTERNAL WATER PRESSURE SENSOR, BUILT-IN LOW WATER CUT-OFF WITH TEST BUTTON, 120V CONVENIENCE OUTLET.
 - 4.9 GALLON BOILER WATER CONTENT, 32# WATER CONNECTION, 20# GAS CONNECTION.
 - BOILER CIRCULATING PUMP TO BE GRUNDFOS UPS26-99 RATED FOR 26GPM @ 14 FT OF HEAD.
 - PROVIDE WALL MOUNTING BRACKET.

UNIT HEATER SCHEDULE

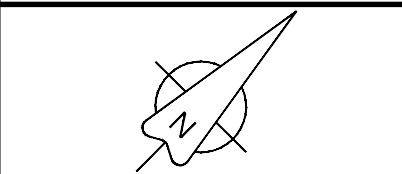
No.	MAKE/MODEL	LOCATION	TYPE	HEATING CAP. (MBH)	AIRFLOW (CFM)	L.A.T. (°F)	WATER FLOW (GPM)	E.W.T. (°F)	MOTOR	BASIS OF DESIGN
UH-1	SIGMA 084H	BASEMENT MECH RM	HORIZ. DISCHARGE	69.3	1610	99	7.1	180	1/6 HP 575/3/60 2.0A	INSTALL UNIT IN PLACE OF EX. RECONNECT EX HWS/R.

LEGEND

	NEW PIPING, DUCTWORK, EQUIPMENT
	DIRECTION OF FLOW
	DOMESTIC COLD WATER (DCW)
	DOMESTIC HOT WATER (DHW)
	DOMESTIC HOT WATER RECIRC (DHW-R)
	VENT
	GAS LINE
	CONDENSATE
	DRAIN
	HEATING WATER RETURN
	HEATING WATER SUPPLY
	TEMPERATURE GAUGE
	PRESSURE GAUGE
	FLOW SWITCH
	UNION
	AUTOMATIC AIR VENT
	PUMP
	AUTOMATIC CONTROL VALVE - THREE WAY
	GATE VALVE
	CIRCUIT SETTER (CBV)
	NON-RETURN VALVE (CHECK VALVE)
	Y-STRAINER
	BUTTERFLY VALVE
	TRAP
	FIRE EXTINGUISHER
	PIPE DROP
	SPRINKLER HEAD UPRIGHT (EXPOSED CEILING)
	FLOOR DRAIN (FD) , FUNNEL FLOOR DRAIN (FFD)
	STARTER
	EQUIPMENT TAG
	THERMOSTAT
	TEMPERATURE SENSOR (AQUASTAT)
	DIRECTION OF AIR FLOW
	INLINE FAN
	BALANCING DAMPER (SINGLE BLADE)
	EXISTING DUCTWORK
	FUNNEL FLOOR DRAIN
	FLOOR DRAIN
	HUB DRAIN
	EXPANSION
	EXISTING
	CONNECT TO EXISTING
	AUTOMATIC AIR VENT
	NORMALLY CLOSED

GENERAL NOTES:

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03	MAR 26, 26	MSK	ISSUED FOR TENDER
02	JUN 11, 25	MSK	ISSUED FOR REVIEW
01	MAY 23, 25	MSK	ISSUED FOR REVIEW

CLIENT:

CONSULTANT:

PROBUILD ENGINEERING
50 Shandon Dr.,
Toronto ON M1R 4M5, Canada
Tel: (416) 671-0054
www.ProBuildEngineering.ca
info@ProBuildEngineering.ca

PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
3313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:

MECH LEGEND,
SCHEDULE & KEYPLAN

PROJECT NO:

MK-2025-03

FILE NO:

PBE-25-03

DATE:

MAY 2025

SCALE:

AS NOTED

DRAWN BY:

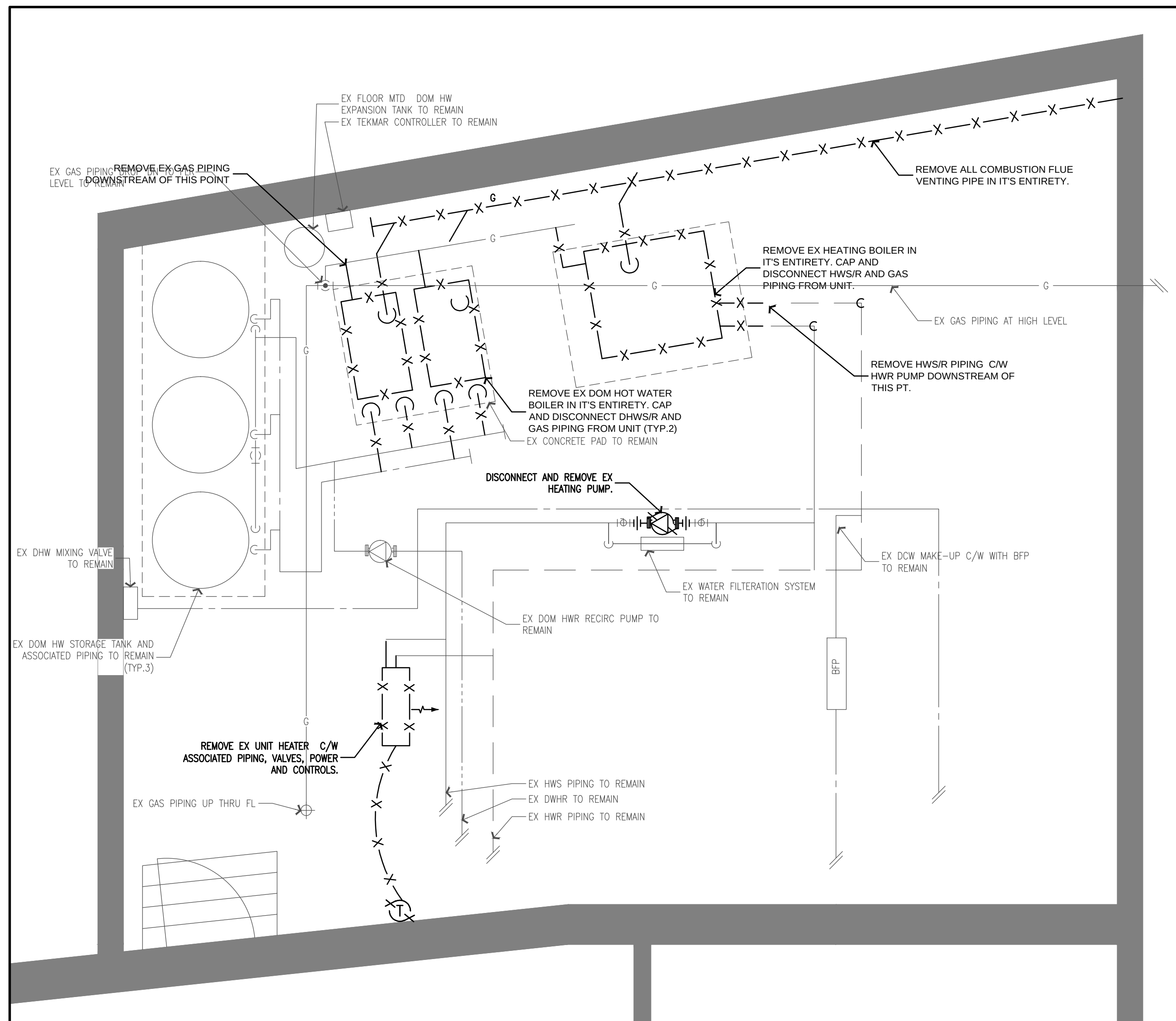
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CHECKED BY:

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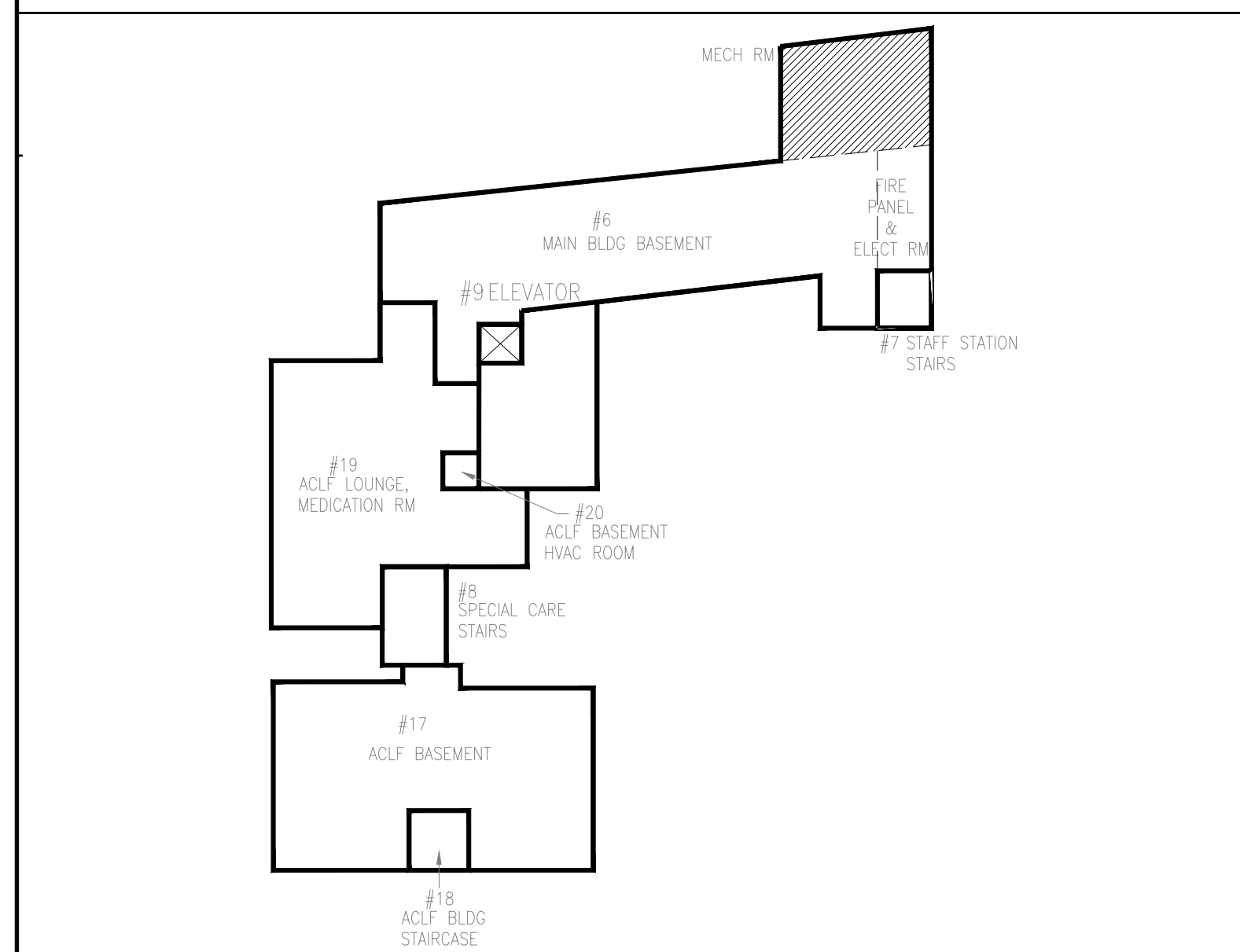
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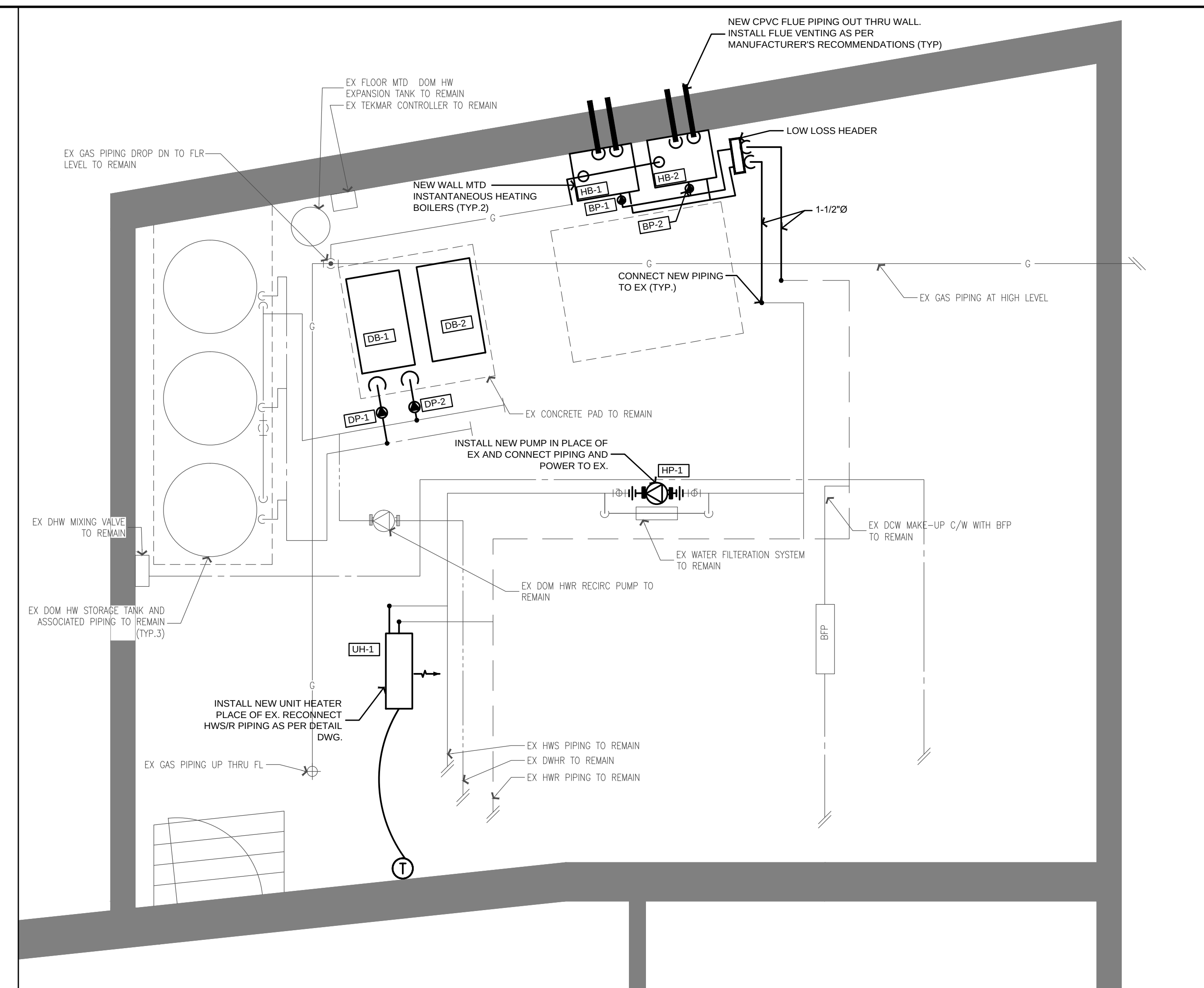


MECH RM DEMO PLAN

SCALE: 3/8" = 1'-0"



BASEMENT KEY PLAN



MECH RM NEW PLAN
SCALE: 3/8" = 1'-0"

GENERAL NOTES:

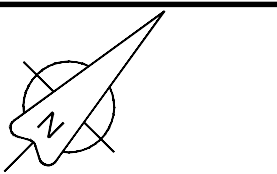
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01	MAY 23, 25	MK	ISSUED FOR REVIEW
REV.	DATE	NAME	DESCRIPTION

CONSULTANT:



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Toronto ON M1R 4M5, Canada
Tel: (416) 671-0054
www.ProBuildEngineering.ca
info@ProBuildEngineering.ca

PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:
MAIN BLDG MECH RM
PLAN (BASEMENT
LEVEL)

PROJECT NO:
MK-2025-03

FILE NO: PBE-25-03

DATE: MAY 2025 | 0

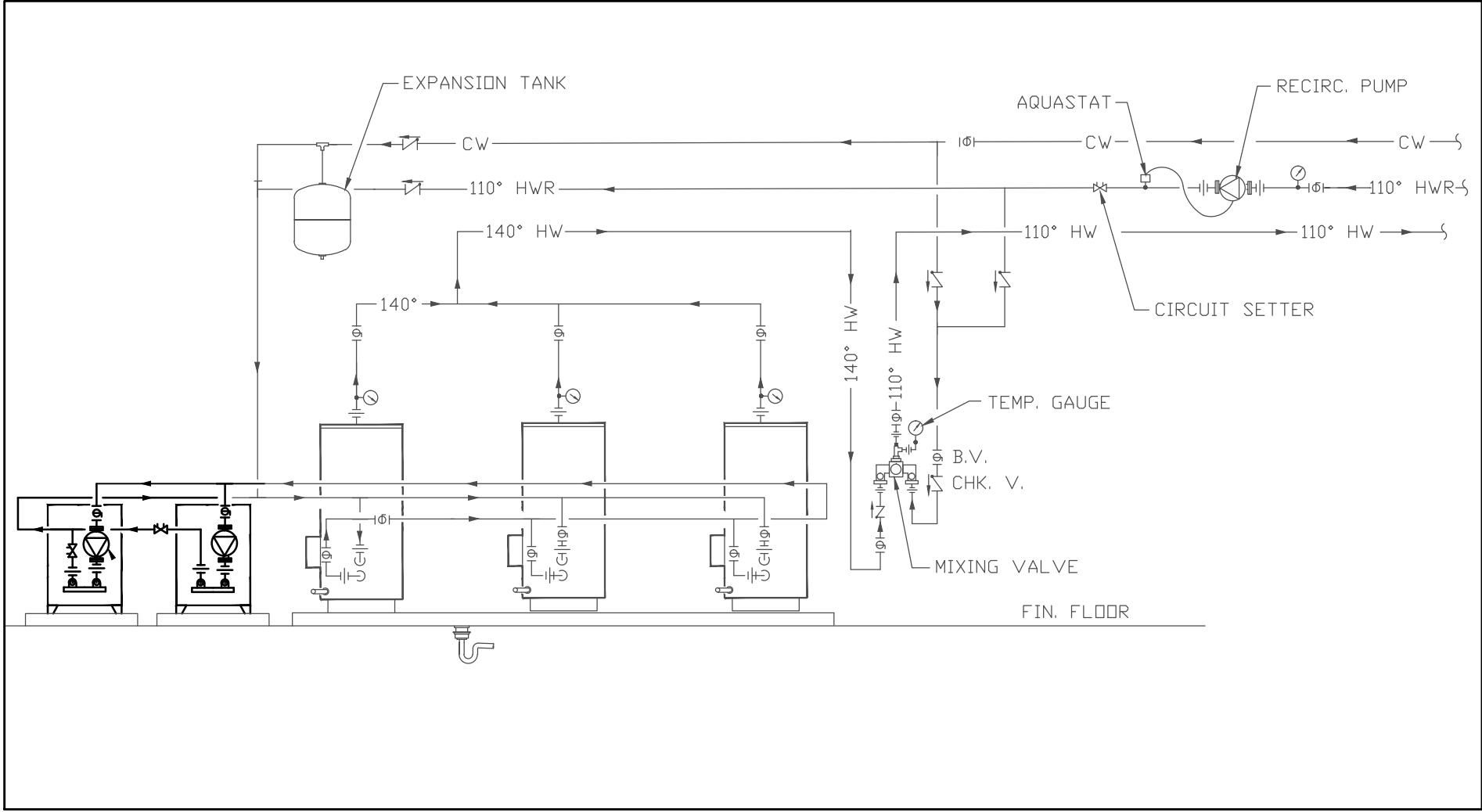
SCALE: AS NOTED

SCALE:	AS NOTED
DRAWN BY:	IF

CHECKED BY:	MSK

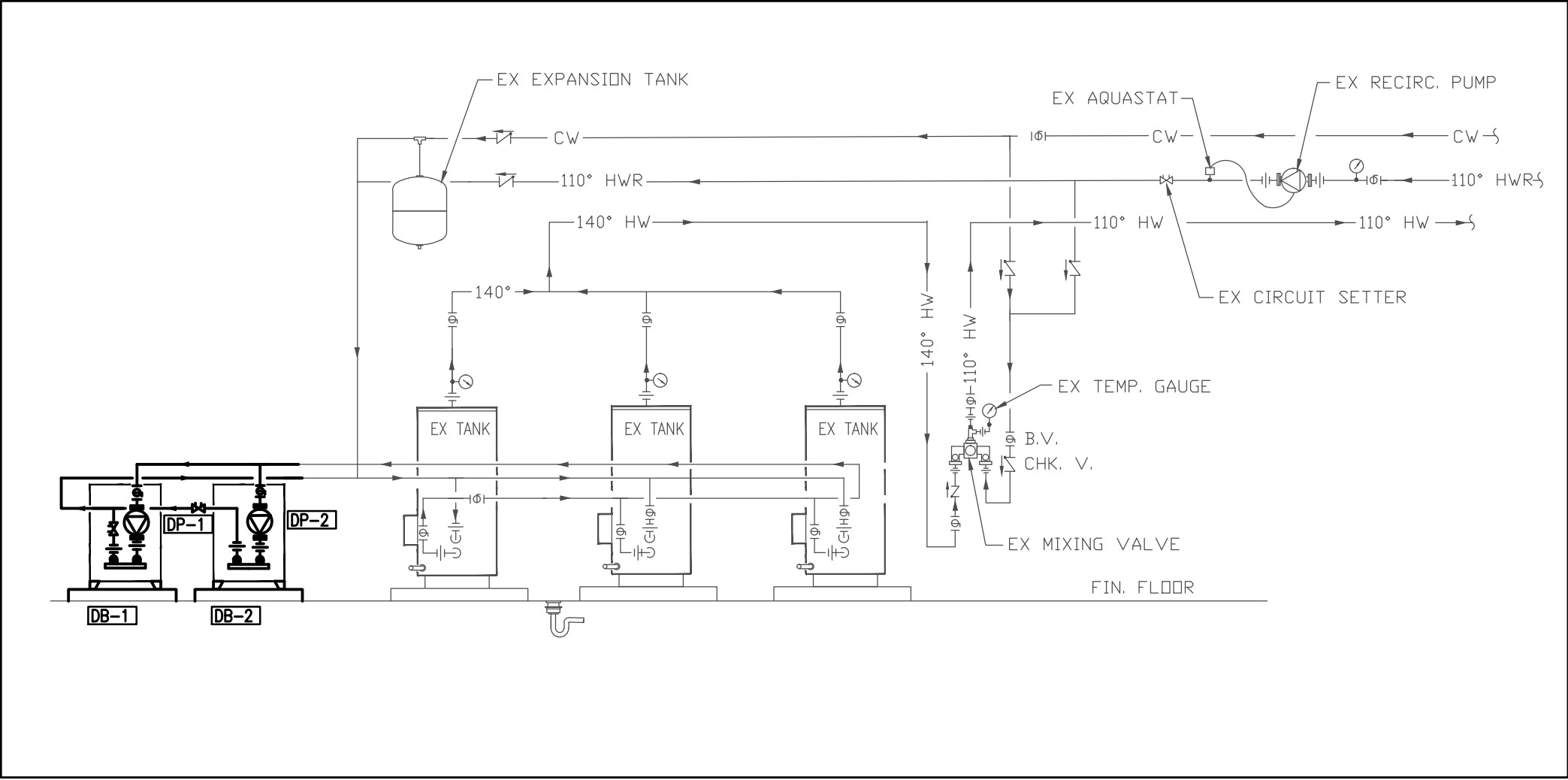
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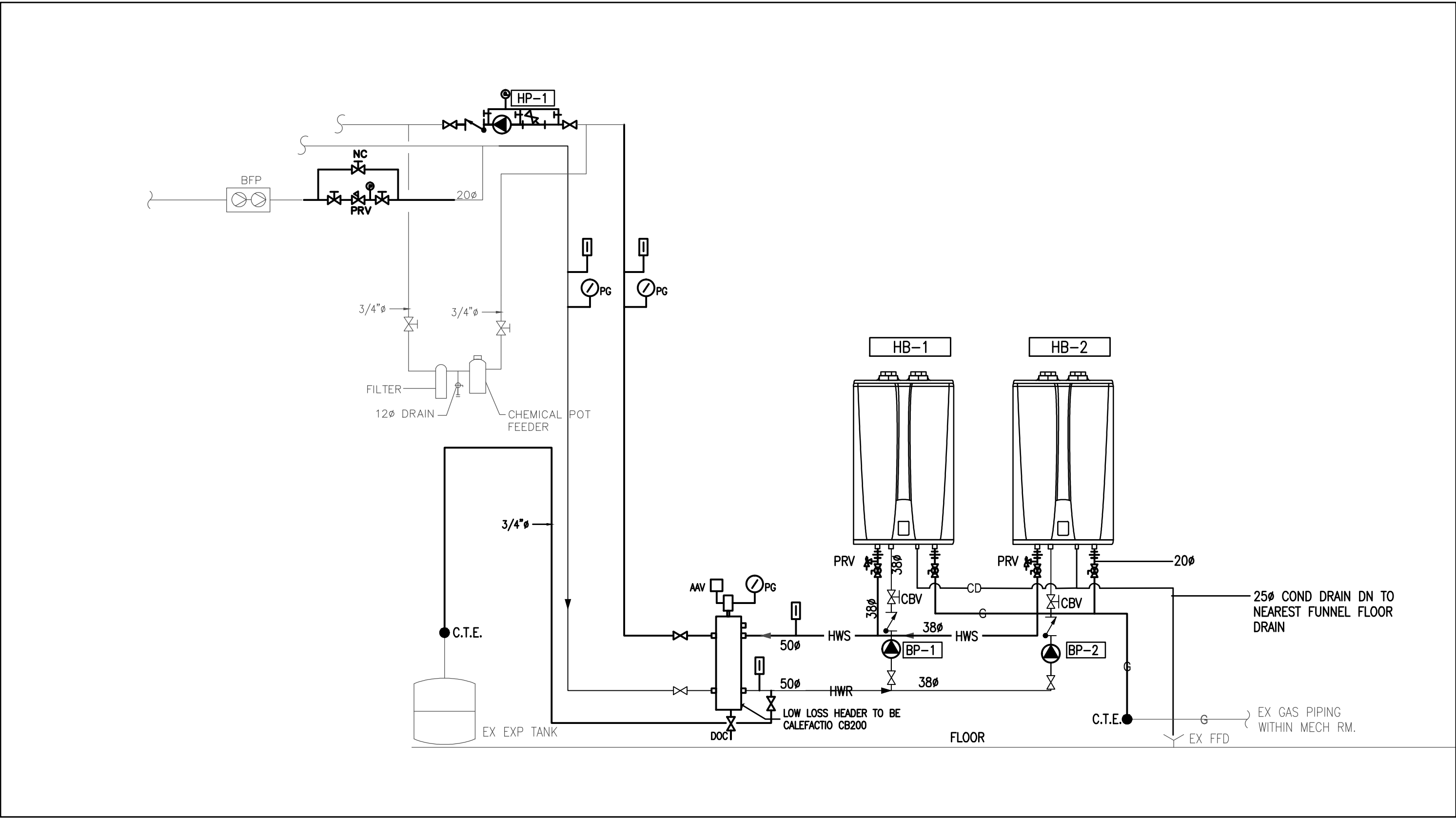
DHW PIPING DEMO SCHEMATIC

SCALE: 1/8" = 1'-0"



DHW PIPING NEW SCHEMATIC

SCALE: 1/8" = 1'-0"



HEATING SYSTEM SCHEMATIC

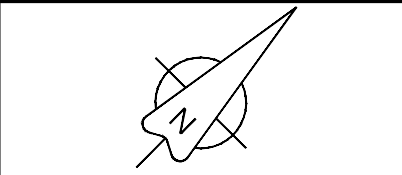
SCALE: 1/8" = 1'-0"

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REV.	DATE	NAME	DESCRIPTION
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CLIENT:

CONSULTANT:

PROBUILD ENGINEERING
50 Shandon Dr.,
Toronto ON M1R 4M5, Canada
Tel: (416) 671-0054
www.ProBuildEngineering.ca
info@ProBuildEngineering.ca

PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:

MECH RM HEATING &
DHW PIPING SCHEMATIC

PROJECT NO:

MK-2025-03

FILE NO:

PBE-25-03

DATE:

MAY 2025

SCALE:

AS NOTED

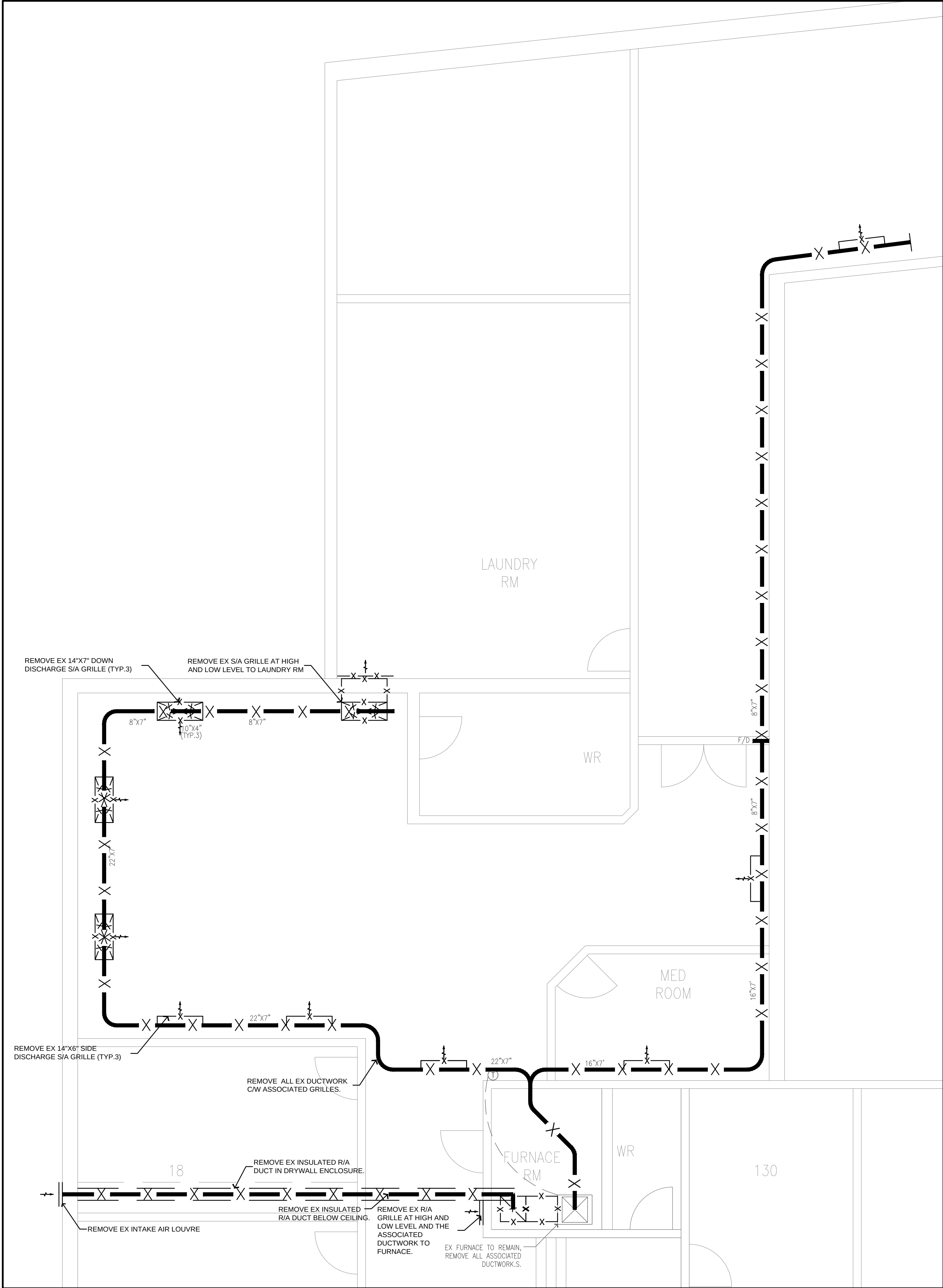
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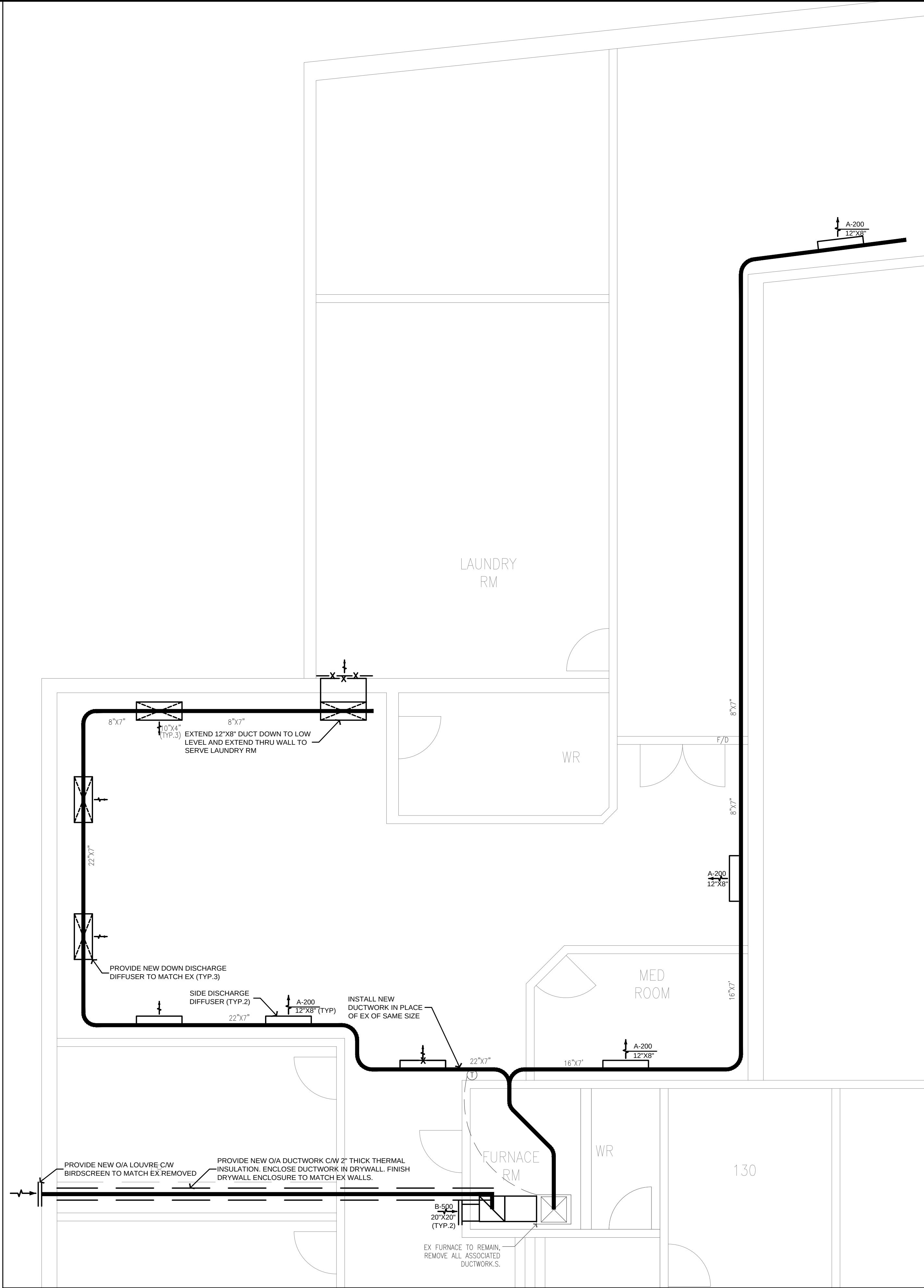
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MSK

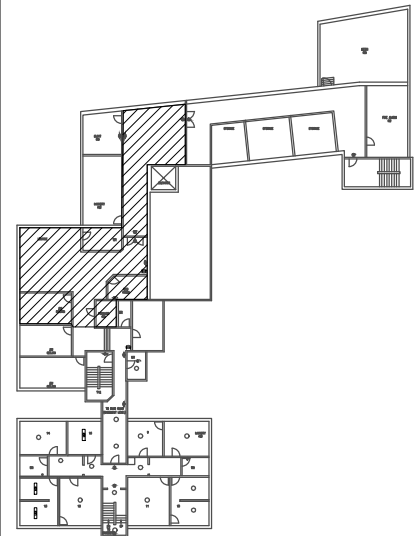
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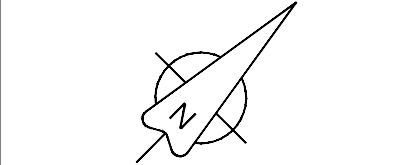
LOUNGE MECH DEMO PLAN
SCALE: 3/8" = 1'-0"



LOUNGE MECH NEW PLAN
SCALE: 3/8" = 1'-0"



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01	MAY.23.25	MK	ISSUED FOR REVIEW

CLIENT:

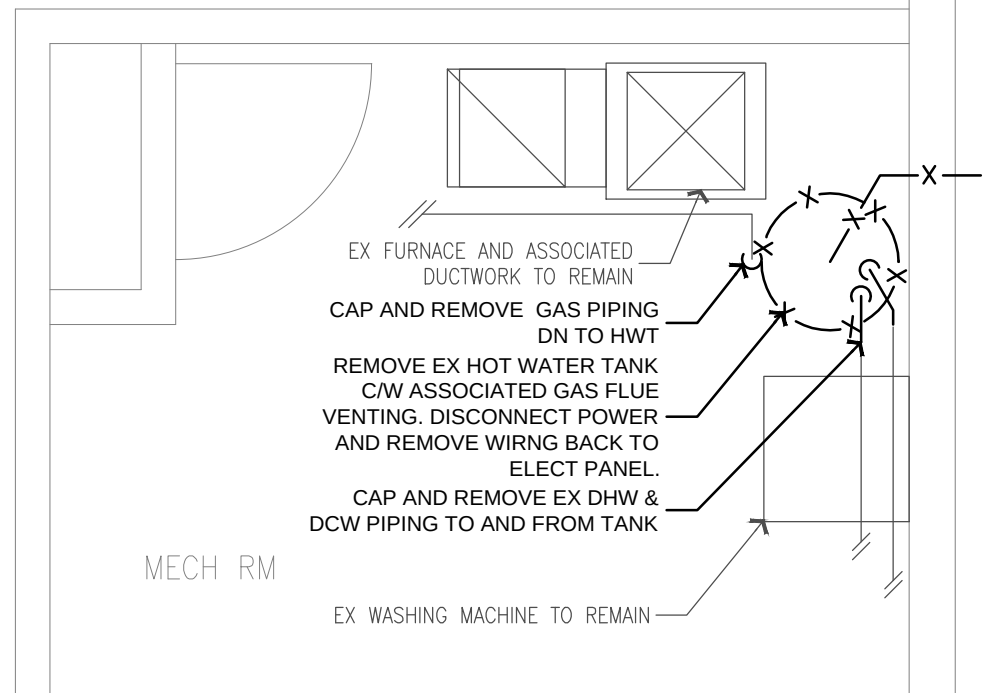
CONSULTANT:
PROBUILD ENGINEERING
50 Shandon Dr.,
Toronto ON M1R 4M5, Canada
Tel: (416) 671-0054
www.ProBuildEngineering.ca
info@ProBuildEngineering.ca

PROJECT NAME:
BUILDING UPGRADES
BETHANY RESIDENCE
313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:
BASEMENT LOUNGE
HVAC PLAN

PROJECT NO.: MK-2025-03
FILE NO.: PBE-25-03
DATE: MAY 2025
SCALE: AS NOTED
DRAWN BY: IE
CHECKED BY: MSK
DRAWING NO.: M4

#23 HOME
1123 HOMEWOOD
DR

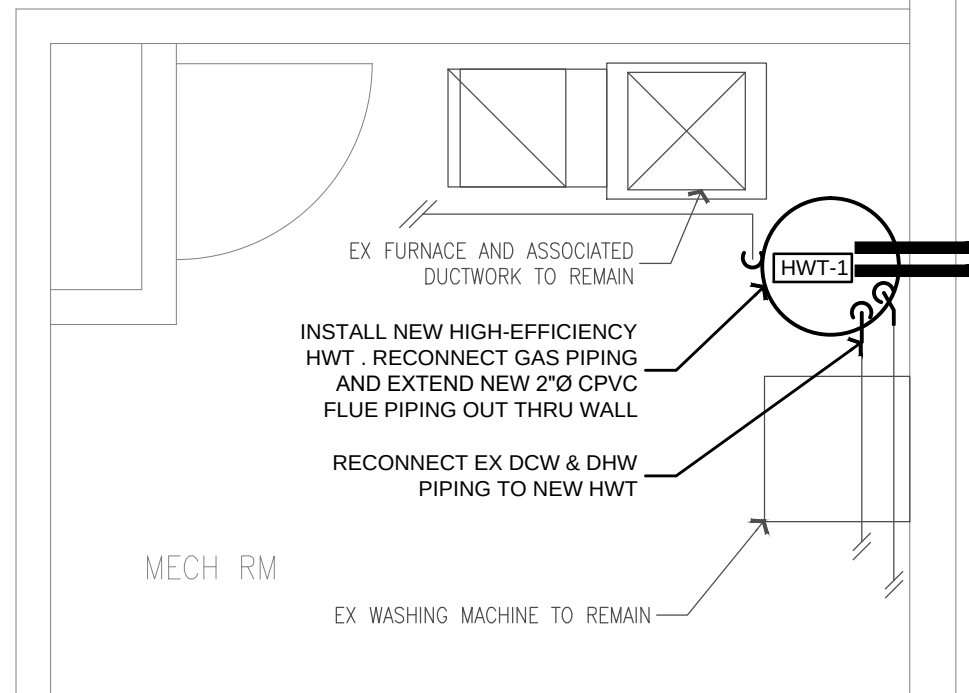


MECH RM

LAUNDRY RM DEMO PLAN

SCALE: 3/8" = 1'-0"

#23 HOME
1123 HOMEWOOD
DR



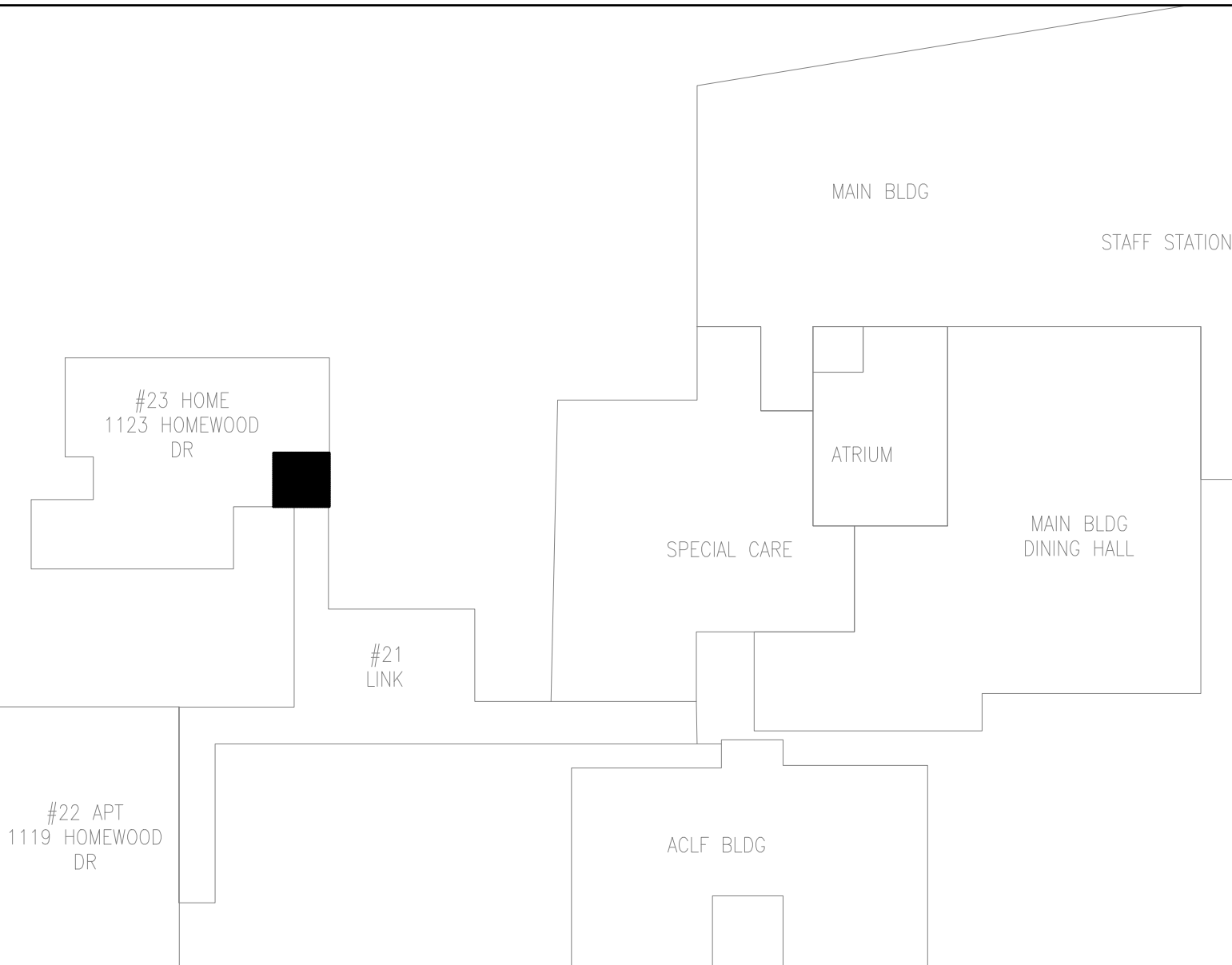
MECH RM

LAUNDRY RM NEW PLAN

SCALE: 3/8" = 1'-0"

PLUMBING FIXTURE SCHEDULE

HWT HOT WATER SYSTEM – STORAGE TYPE – NATURAL GAS OR PROPANE
A.O. SMITH BTH-120 NG, 95% THERMAL EFFICIENCY, INPUT RATING OF 120,000BTU/H, 138GPH (522LPH) RECOVERY AT 100°F, 160 PSI MAXIMUM HYDROSTATIC WORKING PRESSURE. NATURAL GAS, SPIRAL SHAPED, GLASS LINED HEAT EXCHANGER, HIGH EFFICIENCY MODULATING PRE-MIX POWERED BURNER, ADVANCE ELECTRONIC GAS CONTROL SYSTEM, DIRECT SPARK IGNITOR, 60 GALLONS (227 LITERS) STORAGE CAPACITY, STEEL TANK CONSTRUCTION, POWERED ANODES FOR CORROSION PROTECTION, BLUE DIAMOND GLASS-LINED, 3 YEAR LIMITED WARRANTY AGAINST LEAKS, POWER VENT OR DIRECT VENT DESIGN OPTIONS. U.S. DEPARTMENT OF ENERGY AND CURRENT EDITION OF ASHRAE/IESNA 90.1 THERMAL EFFICIENCY COMPLIANT, ANSI Z21.10.3 – CSA 4.3 STANDARDS, UL TO NSF STANDARD 5 DESIGN CERTIFIED, SCAQMD RULE 1146.2 AND OTHER AIR QUALITY MANAGEMENT DISTRICTS WITH SIMILAR REQUIREMENTS FOR LOW NOX EMISSIONS COMPLIANT, 120V, 60HZ, 1Ø AND 15 AMPS. APPROVED VENT AND INTAKE AIR PIPE MATERIALS: ULC S636 PVC / CPVC, ULC S636 POLYPROPELENE, AL29-4C STAINLESS STEEL



1123 HOMEWOOD KEY PLAN

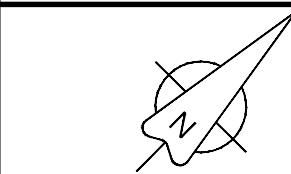
NTS

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02	JUN 11, 25	MK	ISSUED FOR REVIEW
01	MAY 23, 25	MK	ISSUED FOR REVIEW

REV	DATE	NAME	DESCRIPTION

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CONSULTANT:



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PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:

1123 HOMEWOOD DR
GROUND FLOOR PLAN
(LAUNDRY RM)

PROJECT NO:

MK-2025-03

FILE NO:

PBE-25-03

DATE: MAY 2025

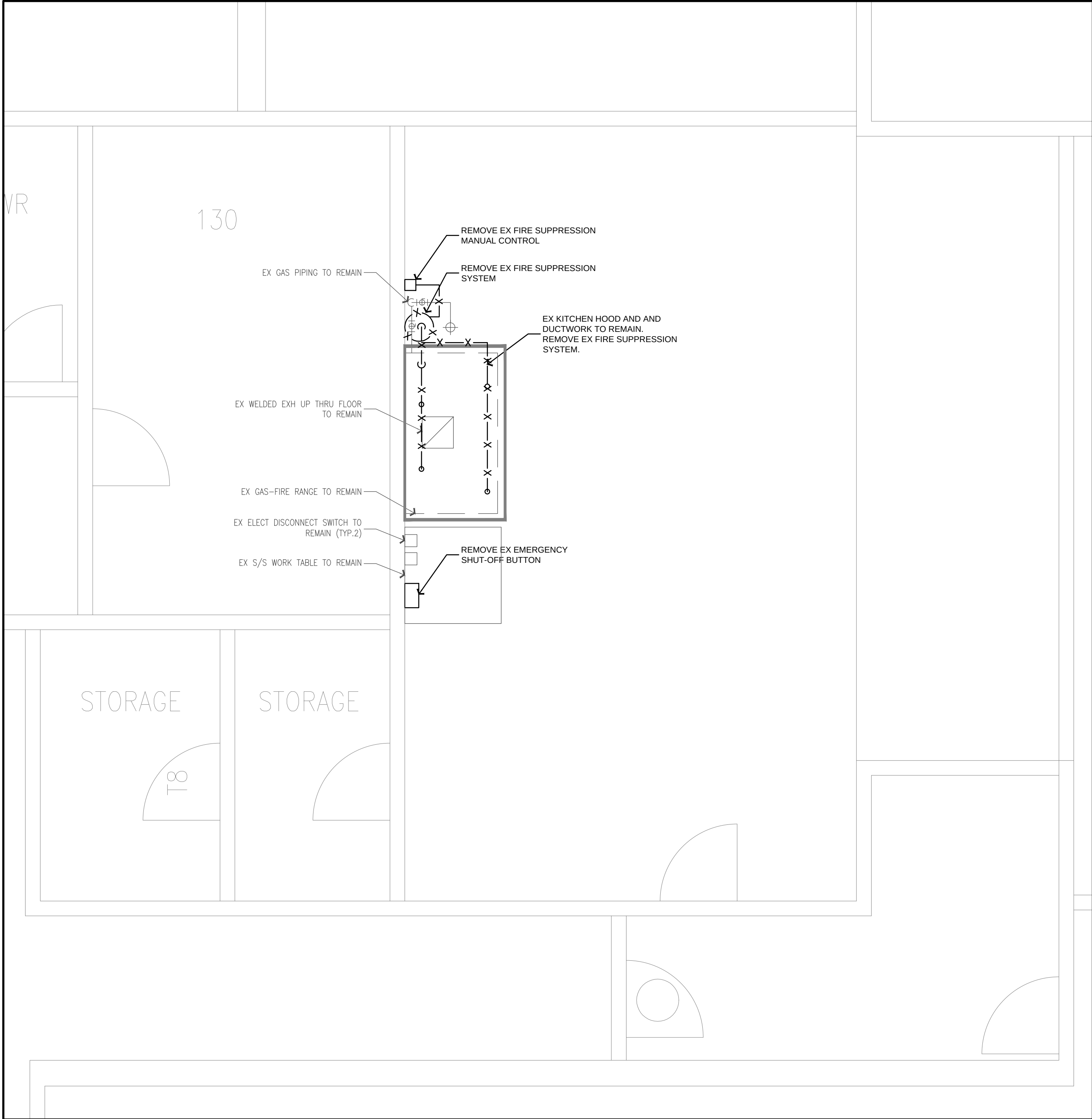
SCALE: AS NOTED

DRAWN BY: IE

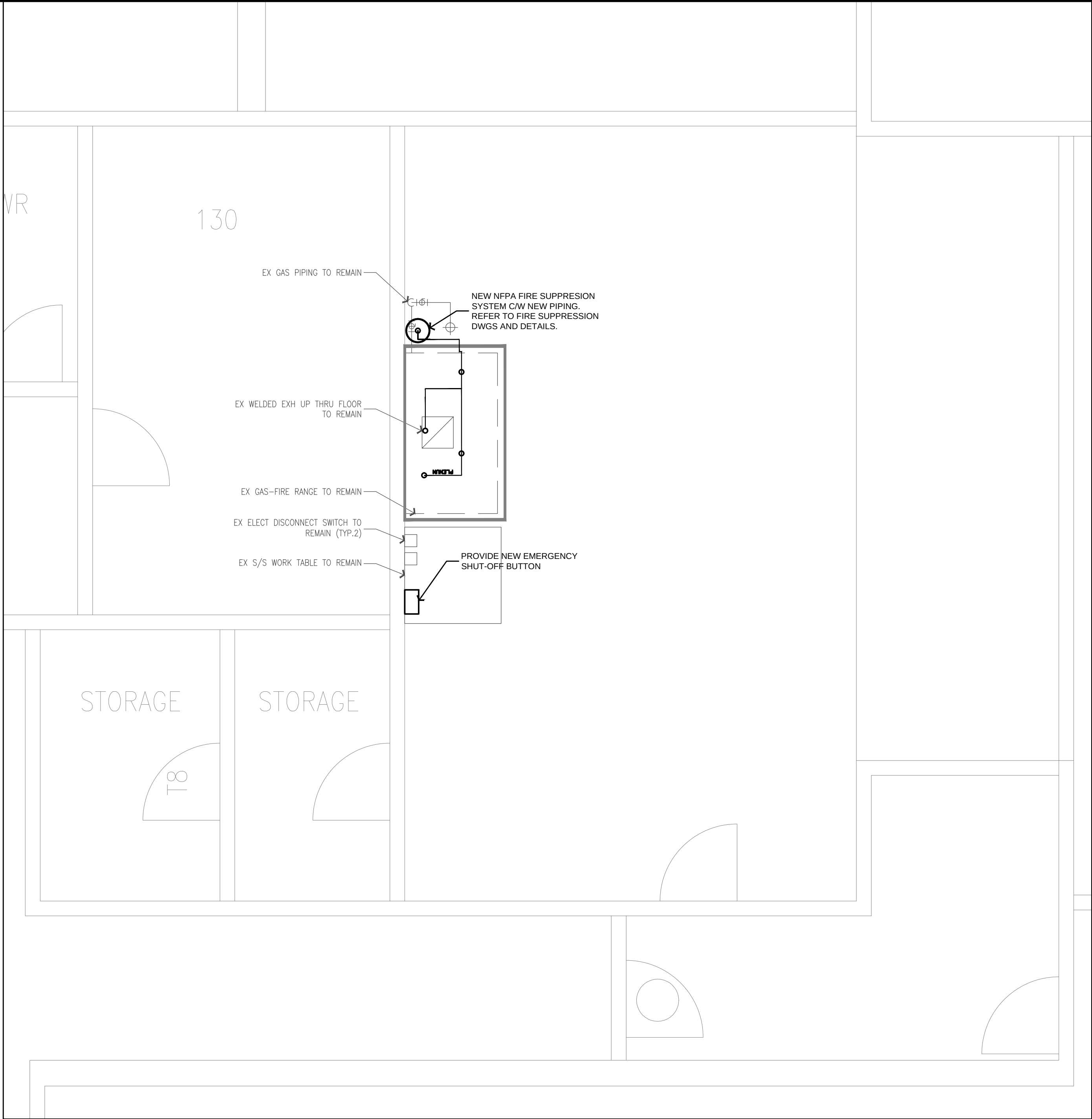
CHECKED BY: MSK

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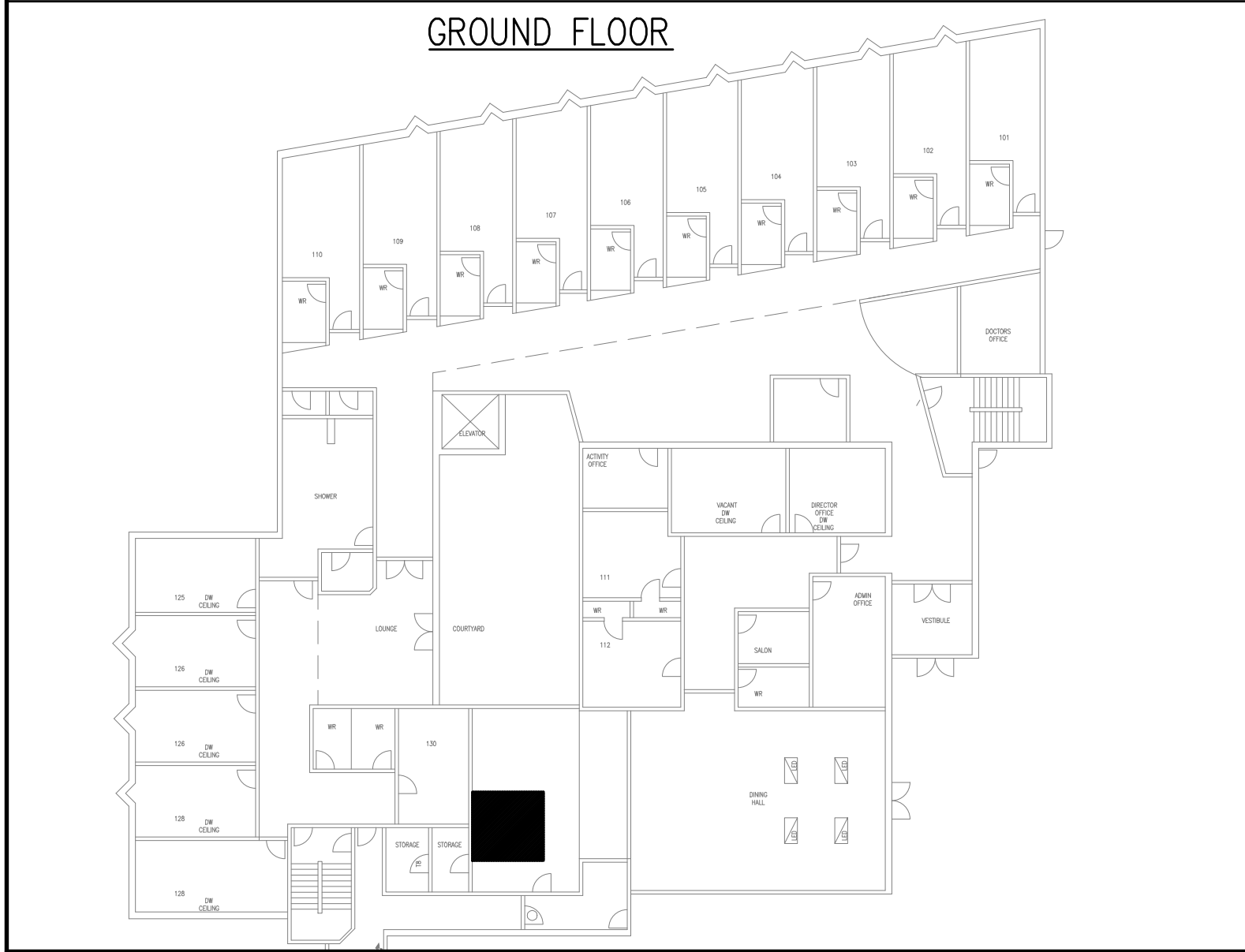
M5



KITCHEN HOOD DEMO PLAN
SCALE: 3/8" = 1'-0"



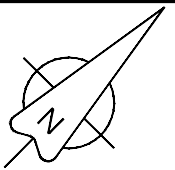
KITCHEN HOOD NEW PLAN
SCALE: 3/8" = 1'-0"



MAIN BLDG GROUND FLOOR KEY PLAN
NTS

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PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:

MAIN BLDG
KITCHEN HOOD
REPLACEMENT
PART 1

PROJECT NO:

MK-2025-03

FILE NO:

PBE-25-03

DATE:

MAY 2025

SCALE:

AS NOTED

DRAWN BY:

IE

CHECKED BY:

MSK

DRAWING NO:

M7

SECTION 21 23 00
WET- CHEMICAL FIRE-EXTINGUISHING SYSTEMS
TAG: TANK Fire Suppression

PART 1 - GENERAL

1.1 SUMMARY

- A. TANK Fire Suppression is a pre-engineered, stored-pressure wet chemical solution extinguishing system.

1.2 SUBMITTALS

- A. The manufacturer assumes no liability for the use or results of use from this document. Specifications are to be reviewed by the engineer to confirm the requirements of the project and meet Federal, State, and Local codes.
- B. As the manufacturer continues product development, it reserves the right to change design and specifications without notice.

1.3 QUALITY ASSURANCE

- A. The TANK Fire Suppression System is ETL Listed in accordance with ANSI/CAN/UL/ULC 300, ULCORD-C 1254.6.
- B. Microprocessor-based control board shall be ETL Listed to UL Standard 864 and CAN/ ULC-S527-II.
- C. TANK Fire Suppression System intended for installation and for use in accordance with the National Fire Protection Association Standards:
- 1. Wet Chemical Extinguishing Systems, NFPA 17A
 - 2. National Electrical Code, NFPA 70
 - 3. National Fire Alarm & Signaling Code, NFPA 72
- D. New York City and FDNY approved under CDA# 5870.
- E. California State Fire Marshal (CFSM), Listing No. 7085-2199:0502.

1.4 WARRANTY

- A. All units shall be provided with the following standard warranties:
- 1. TANK Fire Suppression System is warranted to be free from defects in materials and workmanship, under normal use and service, for a period of 60-months from date of shipment.
- B. Warranty does not cover consumable products such as batteries and nitrogen.
- C. The manufacturer shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 60-month warranty period, upon examination by the manufacturer, such part will be repaired or replaced by manufacturer at no charge. The buyer shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without manufacturer's prior authorization, and all returned equipment shall be shipped by the buyer, freight prepaid to a destination determined by the manufacturer.
- D. Refer to Manufacturer's Operation, Installation, and Maintenance (OIM) Manual for detailed descriptions of what is/is not covered and contact information for warranty claims.

PART 2 - PRODUCTS

2.1 GENERAL

- A. A pre-engineered, fixed pipe, automatic wet chemical agent fire suppression system for protection of all hazard areas associated with cooking operations, including exhaust hoods, plenums, ductwork, and cooking appliances.

2.2 COMPONENTS

- A. Exhaust hood fire system components to be factory installed.
- B. Cylinder and Valve Assembly
- 1. The cylinders shall have a tin-nickel alloy plated brass valve with pressure gauge.
 - 2. Wet chemical agent shall be contained in one or more stored pressure DOT/TC rated steel cylinder and valve assemblies.
 - 3. Each cylinder is factory-filled with liquid fire suppressant and pressurized to 200 PSIG at 70°F.
 - 4. Maximum cylinder flow points = 20.
- C. Distribution Nozzles
- 1. Nozzles shall be located to protect the exhaust ducts, plenums, and all cooking appliances requiring protection.
 - 2. All nozzles shall be equipped with a metal blow off cap. The cap prevents contamination from entering the pipe network and is designed to pop-off upon system discharge, allowing agent to flow to the protected hazard area.
 - 3. All nozzles shall incorporate a stamped part number to easily identify nozzle type.
- D. Distribution System
- 1. The distribution system shall consist of Copper, Schedule 40 black iron, chrome-plated or stainless-steel pipe and fittings. All exposed piping and fittings must be chrome-plated or stainless steel.
 - 2. Fittings shall be minimum class 150. Galvanized fittings shall not be used.

E. Suppression System

- 1. The system control equipment shall be capable of all functions associated with automatically and manually discharging the wet chemical agent from all cylinder and valve assemblies, including automatic shutdown of the heat source or fuel and electrical power to all protected areas upon system discharge.
- 2. Liquid Fire Suppressant shall be Aqueous Potassium Carbonate (APC).
- 3. All mechanical components of the actuator kit shall be enclosed.
- 4. The actuator kit shall be capable of automatic or manual activation means.
- 5. Supervisory Pressure Switch added to monitor operating system pressure.
- 6. For manual activation, an electrically operated manual release shall be used to actuate the system manually.
- 7. For automatic activation, the system will be activated by a Firestat (heat) detector.

F. Electrical

- 1. Electrical Division to provide shunt trip breakers at main power panel, or disconnects, as designated by the Electrical Engineer; interconnection provided at hood control panel for the signal to shut down all electricity in and under the exhaust hood. Shunt trips/disconnects to accomplish shut off of electricity in the event of fire system activation by others.
- 2. Printed circuit board with microprocessor-based controller that provides all the necessary monitoring, timing, and supervision functions required for the reliable operation of the fire system.
- 3. Independent supervised loops incorporate redundancy and fault detection.
- 4. Real-time cloud-based monitoring connection provided with system by ownership.
- 5. Primary power supply, with battery backup for power loss.
- 6. All wiring must be in accordance to NFPA 70 and the Authority Having Jurisdiction (AHJ).
- 7. Electric gas valve provided for equipment below exhaust hood. Coordinate size and installation with Plumbing Division.
- 8. All wiring is to be in accordance with the applicable manufacturer's instructions for the fire alarm control panel, gas shut-off valve, manual reset relay, and contractor supplied shut-off devices.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which the system is installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 APPLICATION

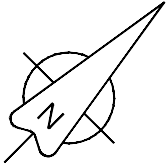
- A. Wet chemical-based fire suppression system for use in commercial kitchens. It can be mounted in the integral cabinet located at the end of the hood or offered as a wall mount package.

3.3 INSTALLATION

- A. As part of this item, provide wall mounted type K handheld portable fire extinguisher, placard, and mounting bracket as required in the immediate vicinity of each cooking area, per NFPA-96 and NFPA-10. Additional fire extinguishers as required in the kitchen area are to be specified by the Architect and provided by the General Contractor.
- B. Install in accordance with manufacturer's instructions, drawings, written specifications, manufacturer's installation manual, and all applicable building codes.
- C. Six-month and twelve-month inspections, servicing, and replacement of components as per NFPA 96 to be provided by the General Contractor or Owner.

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03	MAR 26 26	MK	ISSUED FOR TENDER
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PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:

KITCHEN HOOD
FIRE SUPPRESSION
SYSTEM SPECIFICATIONS

PROJECT NO:
MK-2025-03

FILE NO:
PBE-25-03

DATE: MAY 2025

SCALE: AS NOTED

DRAWN BY: IE

CHECKED BY: MSK

DRAWING NO:
M8

FIRE SYSTEM INFORMATION – JOB#7649475

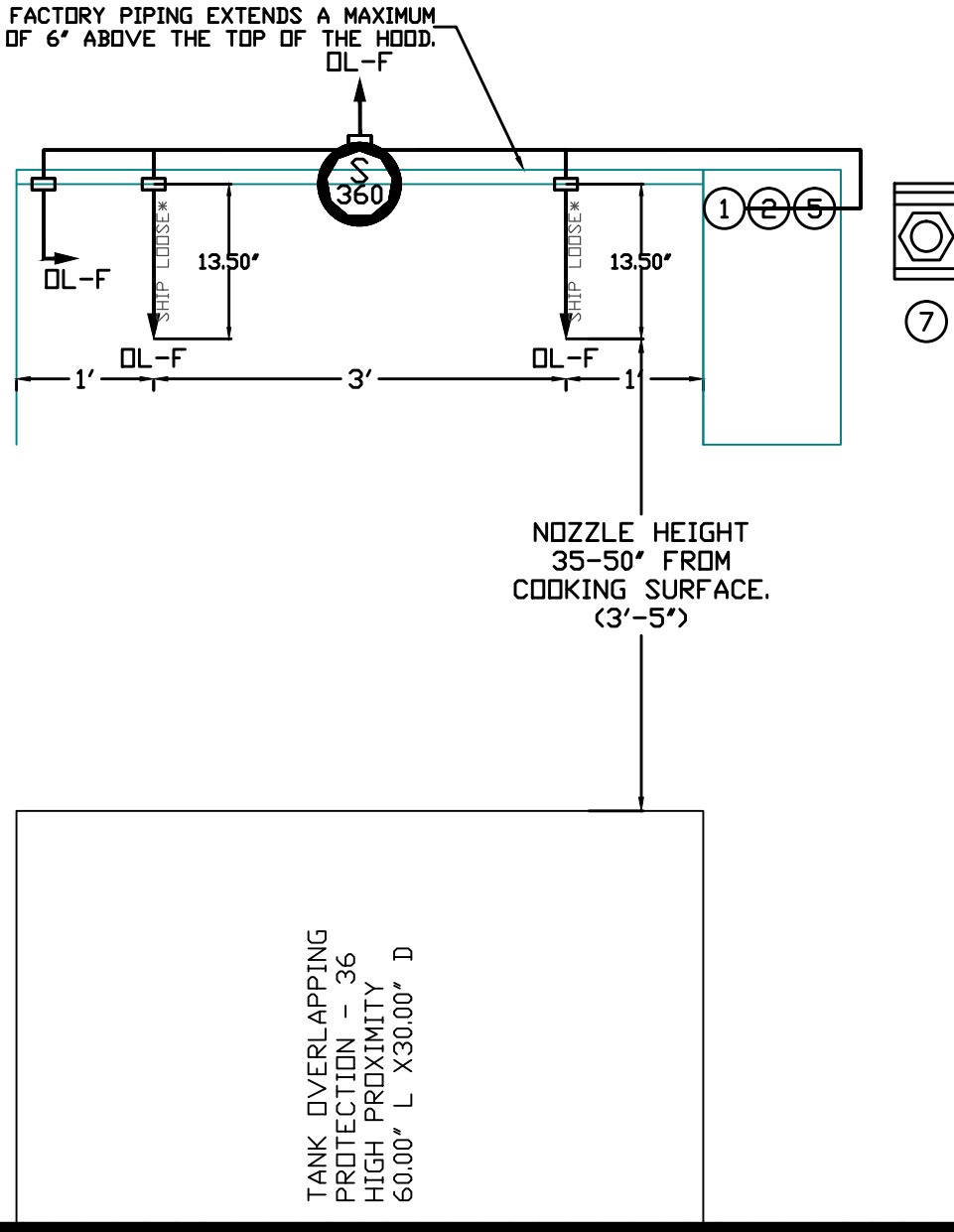
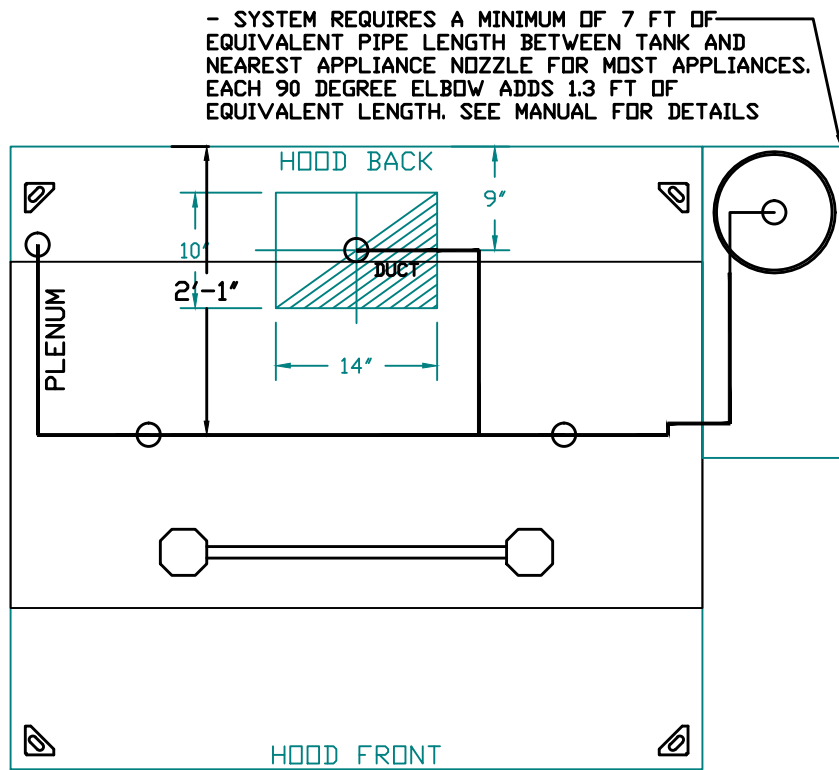
FIRE SYSTEM NO	TAG	TYPE	SIZE	MAX FP	DESIGN FP	INSTALLATION	
						SYSTEM	LOCATION ON HOOD
1		TANK FS	4.0	20	16	FIRE CABINET RIGHT	RIGHT, HOOD 1

GAS VALVE(S)

FIRE SYSTEM NO	TAG	TYPE	SIZE	SUPPLIED BY
1		SC ELECTRICAL	1.500	CAPTIVEAIRE SYSTEMS

FIRE SYSTEM PARTS LIST KEY

FIRE SYSTEM NO	TAG	KEY NUMBER - PART DESCRIPTION	QTY BY FACTORY	QTY BY DIST
1		0 - 0 - TANK FIRE SUPPRESSION POST-DISCHARGE PROCEDURE UTILITY CABINET LABEL SHEET.	1	0
		0 - 0 - TANK FIRE SUPPRESSION MAINTENANCE GUIDE UTILITY CABINET LABEL SHEET.	1	0
		0 - 0 - 12-F28021-32144-0T-360 DUCT FIRE THERMOSTAT WITH 12 FOOT WIRE LEADS. NO, CLOSE ON TEMP RISE AT 360°F. (A0034310).	1	0
		0 - 0 - 32-00002 QUIK SEAL - 1/2" (UL).	1	0
		0 - 0 - 4429K153 1/2" MALE NPT TO 1/2" FEMALE NPT ELBOW, BRASS.	1	0
		0 - 0 - 4429K422 1/2" X 1/4" BRASS REDUCING BUSHING.	1	0
		0 - 0 - 79525 1/2" 90 PRO-PRESS ELBOW WITH 1/2"NPT FEMALE CONNECTION, VIEGA.	1	0
		0 - 0 - 79580 1/2" X 1/2" PRO-PRESS TEE X 1/2"NPT FEMALE CONNECTION, VIEGA.	1	0
		0 - 0 - 87-300001-001 TANK - PRESSURIZED TANK USED FOR TANK FIRE SUPPRESSION.	1	0
		0 - 0 - 87-300030-001 PRIMARY ACTUATOR KIT (PAK) - ACTUATOR AND RELEASE SOLENOID ASSEMBLY, ONE NEEDED PER FIRE SYSTEM, SUPERVISED, TANK FIRE SUPPRESSION.	1	0
		0 - 0 - 87-300033-001 DIN CONNECTOR, CANFIELD PART #5J560-201-EU0A, TANK FIRE SUPPRESSION, SUBMINATURE SOLENOID CONNECTION (CED VENDOR 30377).	1	0
		0 - 0 - 87-300152-001 HARDWARE, SVA BOLTS, TANK FIRE SUPPRESSION.	4	0
		0 - 0 - 9055455PC PRO PRESS 1/2 PRESS X PRESS 90 ELBOW LD.	4	0
		0 - 0 - 9097200PC PRO PRESS PC611 1/2 PRESS TEE LD.	3	0
		0 - 0 - 98694A115 HARDWARE, DATANKLOCK LOCKING BRACKET SQUARE NUTS 5/16" ZINC, TANK FIRE SUPPRESSION.	2	0
		0 - 0 - A0034332 JUNCTION BOX FOR MANUAL PULL STATION. 1.5" DEEP BACK BOX, RED COLOR.	1	0
		0 - 0 - A31484 1/4" NPT SCHRADER VALVE AND CAP, JB INDUSTRIES. 1/4" FLARE X 1/4" MPT HALF UNION. USED ON TANK SERVICE PORT.	1	0
		0 - 0 - B1145 3/8" BLACK IRON 90 ELL.	2	0
		0 - 0 - DATANKLOCK DISCHARGE ADAPTER TANK LOCKING PLATE FOR FIRE SYSTEM TANK INSTALLATION IN UTILITY CABINETS, TANK FIRE SUPPRESSION.	1	0
		0 - 0 - TANK STRAP TANK STRAP - USED FOR TANK FIRE SUPPRESSION.	3	0
		0 - 0 - TFS-UCTANKBRACKET TANK BRACKET FOR FIRE SYSTEM TANK INSTALLATION IN UTILITY CABINETS, TANK FIRE SUPPRESSION.	1	0
		0 - 0 - WK-283952-000 DISCHARGE ADAPTER, TANK FIRE SUPPRESSION.	1	0
		16 - 16 - 79210 1/2" X 3/8" NPT MALE ADAPTER, VIEGA.	4	0
		16 - 16 - DL-F NOZZLE - TANK PROTECTION APPLIANCE COVERAGE NOZZLE (INCLUDES METAL BLOW OFF CAP, LANYARD, USED WITH CHROME-PLATED PIPE).	4	0
		26 - 26 - QSA-3/8 QUIK SEAL - 3/8" (UL).	4	0
		34 - 34 - A0034331 RED COLOR - 24VDC SINGLE ACTION MANUAL ACTUATION DEVICE (PUSH/PULL STATION) WITH PROTECTIVE COVER, ONE (1) NORMALLY OPEN CONTACT.	1	0



NOTES

- FIELD PIPE DROPS AS SHOWN
- PIPING, ELBOWS, TEES, AND NOZZLES SUPPLIED BY CAS.
- FIELD INSTALLED DROP: FACTORY WILL PROVIDE QTY 2 60IN LONG PIECES OF CHROME PLATED PIPING SHIPPED LOOSE TO BE FIELD-INSTALLED.
- SHIP LOOSE DROP: FACTORY WILL PROVIDE THE EXACT CHROME PIPE LENGTH NEEDED SHIPPED LOOSE TO BE FIELD-INSTALLED.
- RELOCATE NOZZLES IF FLOW PATTERN IS BLOCKED BY SHELVEING, SALAMANDERS, ETC.
- OVERLAPPING COVERAGE SHALL NOT BE USED ON ANY APPLIANCE WITH AN OBSTRUCTION.
- IF APPLICABLE, EXTENDED PRE-PIPED DROPS ARE SHIPPED LOOSE.
- FACTORY PIPING EXTENDS A MAXIMUM OF 6" ABOVE THE TOP OF THE HOOD.

- APPLIANCE DIMENSIONS LISTED REPRESENT THE COOKING SURFACE SIZE, NOT THE OVERALL APPLIANCE SIZE.

- THIS PRE-ENGINEERED FIRE SYSTEM COMPLIES WITH U.L. 300 REQUIREMENTS.

- DL-F NOZZLE PART NUMBER REPLACES 3070-3/8H-10-SS

JOB #: 7649475.

JOB NAME: RESTAURANT - 3313 SUPERIOR CRT OAKVILLE.

SYSTEM SIZE: TANK-SP-1 DESIGN FP: 16. MAXIMUM FP: 20.

HOOD # 1 5' 0.00' LONG x 54' WIDE x 12' HIGH.

RISER # 1 SIZE: 10" x 14".

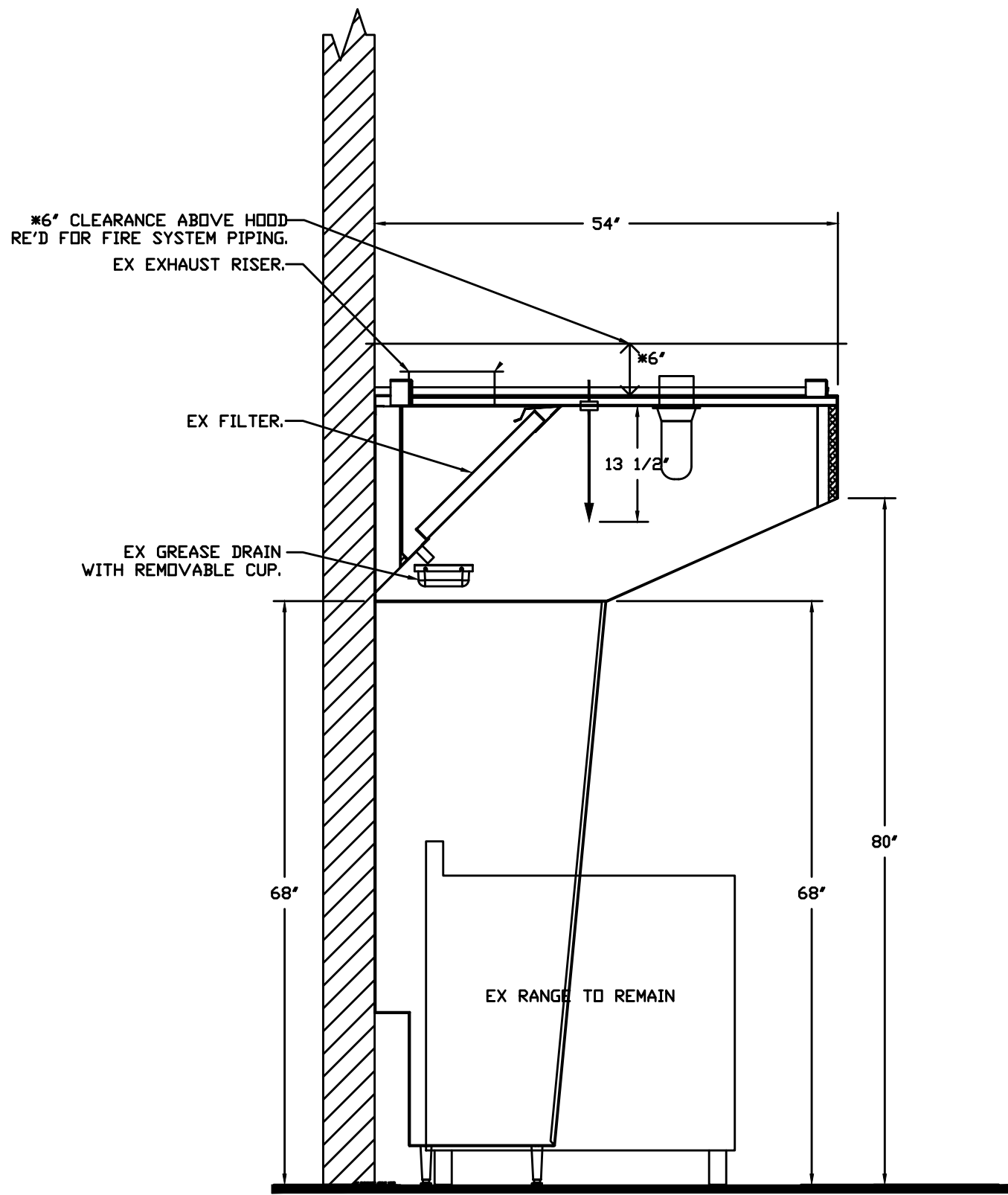
HOOD # 1 METAL BLOW-OFF CAPS INCLUDED.

- HEAVY-DUTY APPLIANCES (RATED 600°F) WILL REQUIRE AN ADDITIONAL DOWNSTREAM FIRESTAT IN THE EVENT THAT THE DUCTWORK CONTAINS ANY HORIZONTAL RUNS OVER 25 FT IN LENGTH.
- MEDIUM TO LIGHT-DUTY APPLIANCES (RATED 450°F) WILL NOT REQUIRE ANY ADDITIONAL DOWNSTREAM DETECTION.

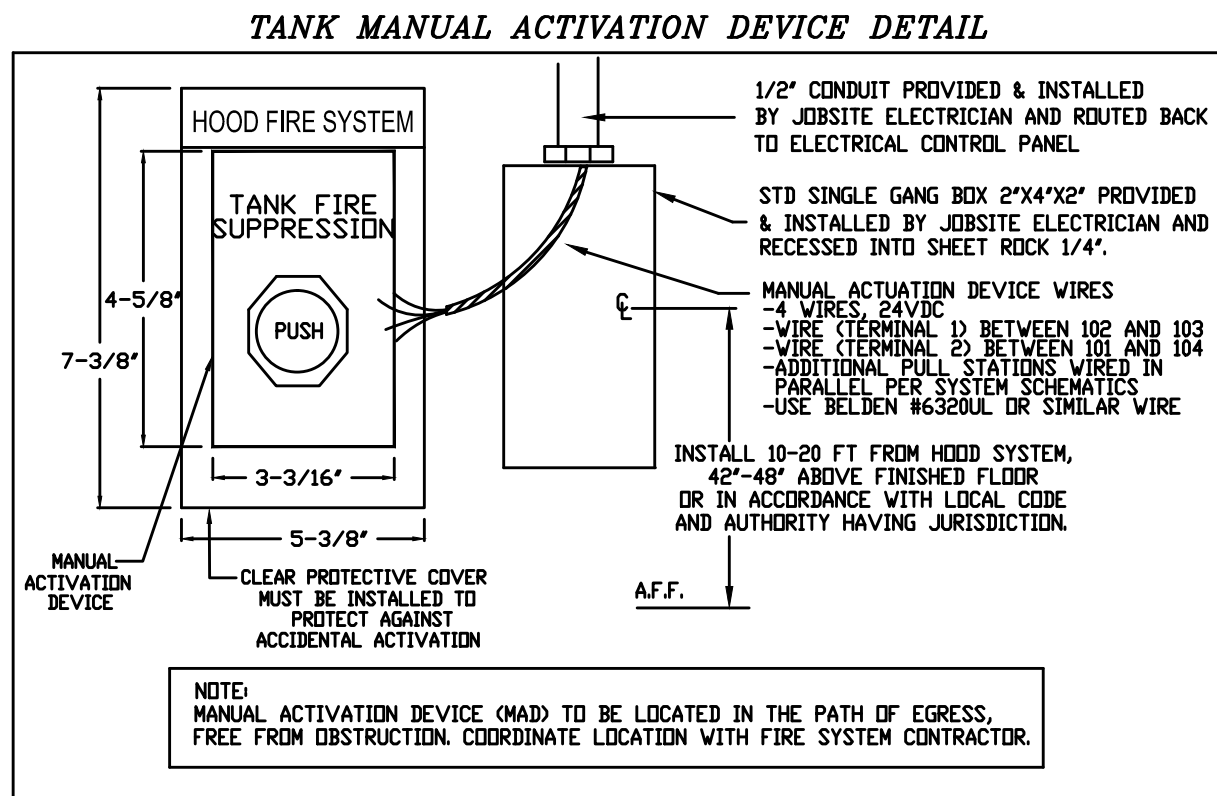
AGENT DISTRIBUTION PIPING LIMITATIONS	
PIPE SECTION	MAX PIPE LENGTH (FT)
MAX SUPPLY LINE TO FIRST OVERLAPPING NOZZLE	42
OVERLAPPING NOZZLE APPLIANCE BRANCH	10
DEDICATED NOZZLE APPLIANCE BRANCH	10

LEGEND - FIRE CABINET TANK SYSTEM

- 4 GALLON TANK.
- PRIMARY ACTUATOR RELEASE.
- SECONDARY ACTUATOR RELEASE.
- PRESSURE SUPERVISION SWITCH.
- PRIMARY HOSE ASSEMBLY.
- SECONDARY HOSE ASSEMBLY.
- REMOTE MANUAL ACTUATION DEVICE.



ELEVATION VIEW

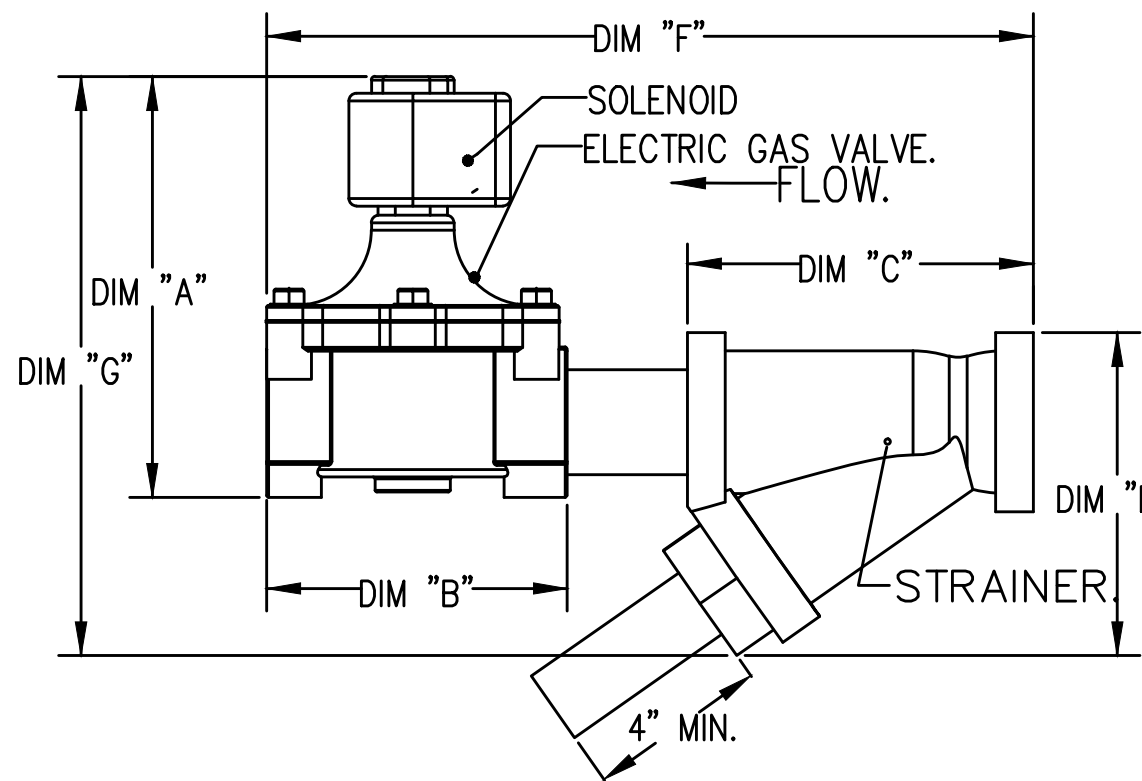


GAS VALVES AND STRAINERS																	
GAS VALVE SIZING							GAS VALVE DIMENSIONS						INSTALLATION		PART NUMBERS		
	TYPE	SIZE	VOLTAGE	MIN. INLET PRESSURE	MAX. INLET PRESSURE	FLOW AT 1 IN.W.C. DROP NATURAL GAS	FLOW AT 1 IN.W.C. DROP PROPANE	DIM "A"	DIM "B"	DIM "C"	DIM "D"	DIM "F"	DIM "G"	PIPE ORIENTATION	GAS VALVE PART NUMBER	STRAINER PART NUMBER	GAS VALVE/STRAINER KIT
GAS VALVE FOR FS#1	ELECTRICAL	1-1/2"	120 VAC	0 PSI (0 IN.W.C.)	5 PSI (138 IN.W.C.)	2,406,000 BTU/HR	1,561,219 BTU/HR	7-5/8"	6-3/8"	5-3/4"	6-3/16"	14-1/8"	12-5/16"	HORIZONTAL/VERTICAL	8214275	4417K87	(SC)EGVA1-1/2

ELECTRIC GAS VALVES ONLY: SOLENOID ORIENTATION:
3/4"-2" 120VAC GAS VALVES CAN BE MOUNTED WITH THE SOLENOID IN ANY POSITION AT OR ABOVE HORIZONTAL.
2 1/2"-3" 120VAC GAS VALVES MUST BE MOUNTED WITH THE SOLENOID VERTICAL AND UPRIGHT.
24VDC GAS VALVES MUST BE MOUNTED WITH THE SOLENOID VERTICAL AND UPRIGHT.

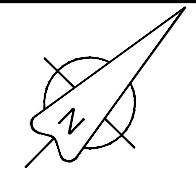
ALL GAS VALVES/STRAINERS
PROPER CLEARANCE MUST BE PROVIDED IN ORDER TO SERVICE THE STRAINERS A MINIMUM OF 4" CLEARANCE DISTANCE MUST BE PROVIDED AT THE BASE OF THE STRAINER CUSTOMER MUST VERIFY BTU CONSUMPTION AS WELL AS PRESSURE RATING SPECIFIC GRAVITY OF NATURAL GAS = 0.64, SPECIFIC GRAVITY OF LP = 1.52.

CALCULATIONS
TO CALCULATE GAS FLOW FOR OTHER THAN 1 IN.W.C. PRESSURE DROP
NEW BTU/HR = (BTU/HR AT 1 IN.W.C. PRESSURE DROP) X NEW PRESSURE DROP^{0.85}
TO CALCULATE GAS FLOW FOR OTHER THAN 0.64 SPECIFIC GRAVITY
NEW BTU/HR = (BTU/HR AT 0.64) X (0.64 / NEW SPECIFIC GRAVITY)^{0.85}



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PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
3313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:

FIRE SUPPRESSION
SYSTEM DETAIL #1

PROJECT NO:

MK-2025-03

FILE NO:

PBE-25-03

DATE:

MAY 2025

SCALE:

AS NOTED

DRAWN BY:

IE

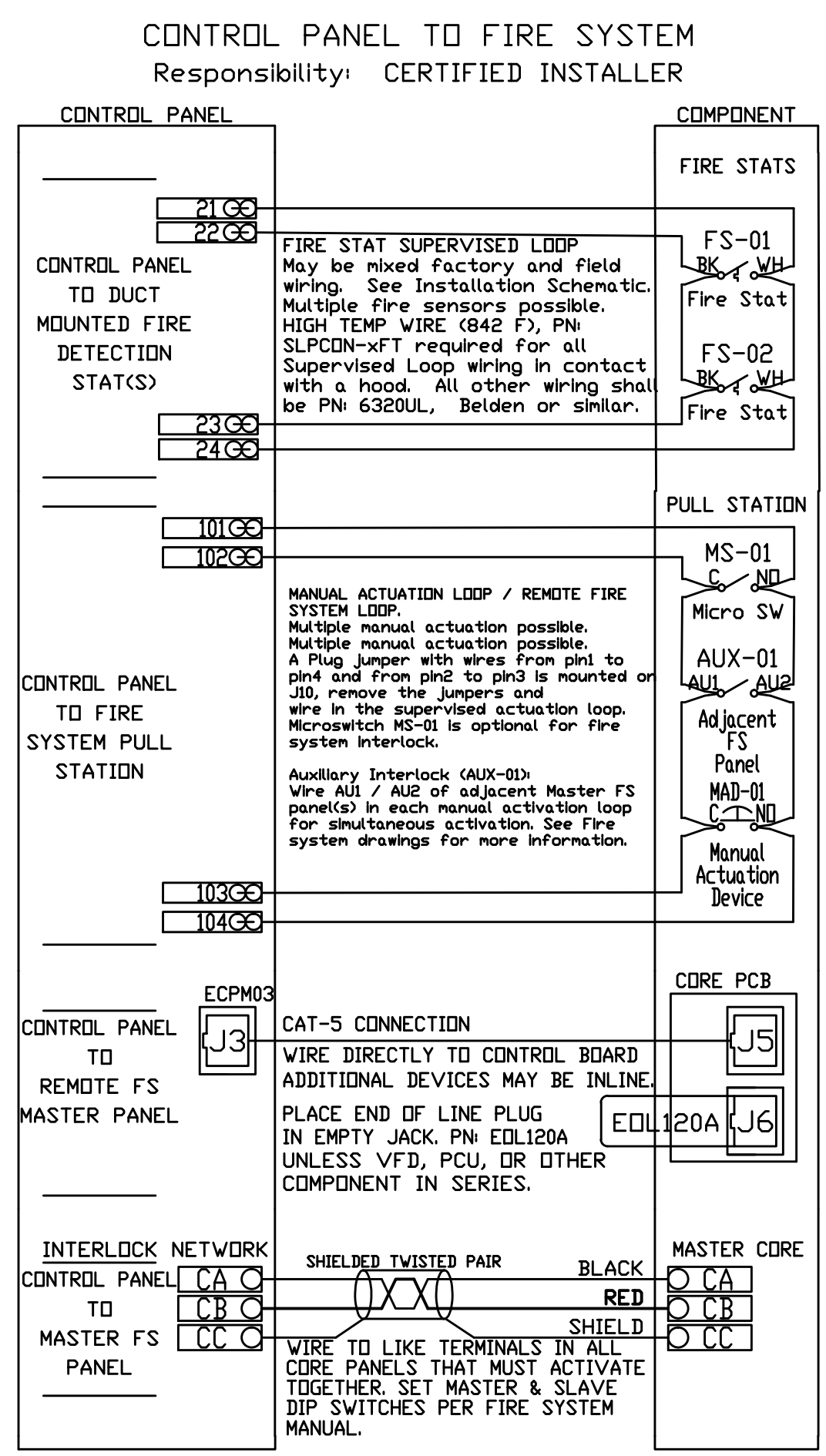
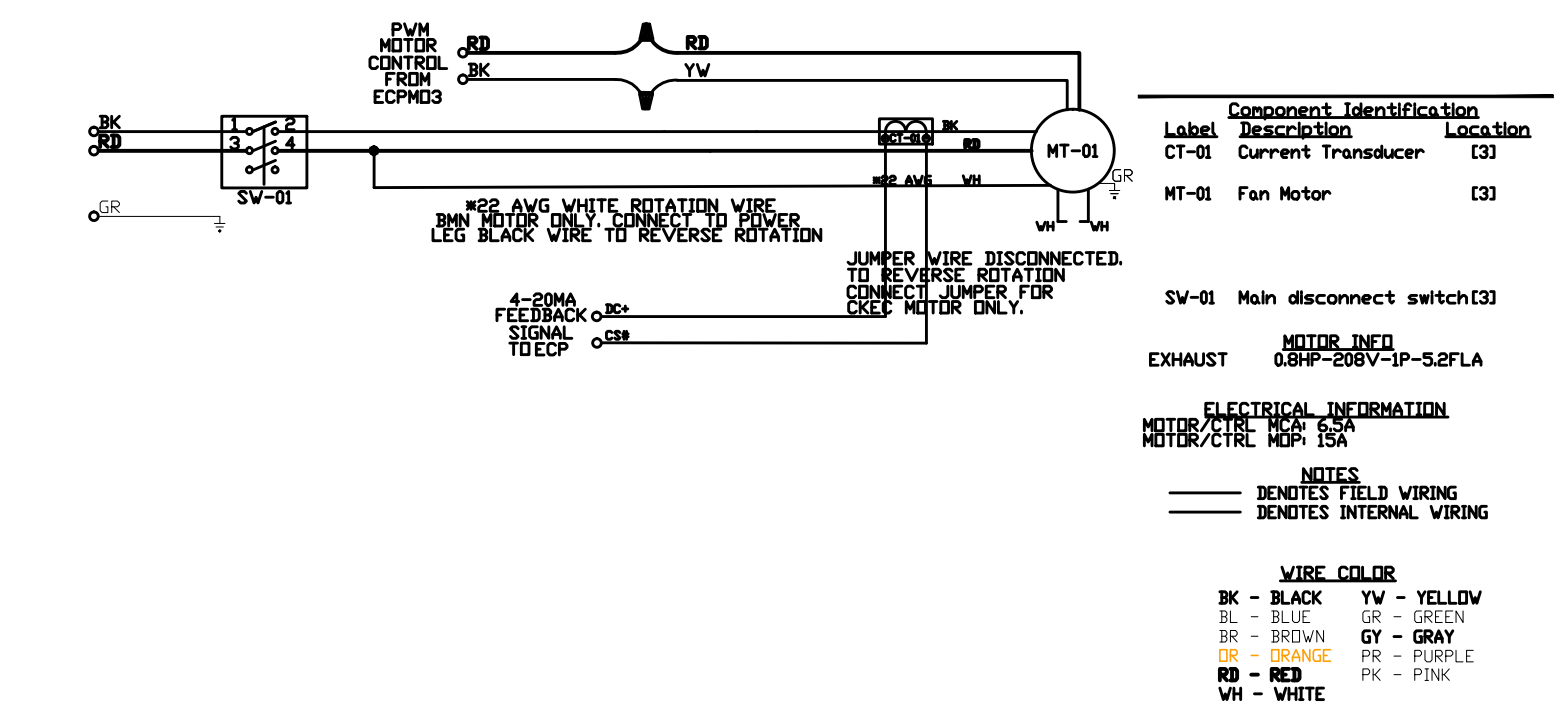
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MSK

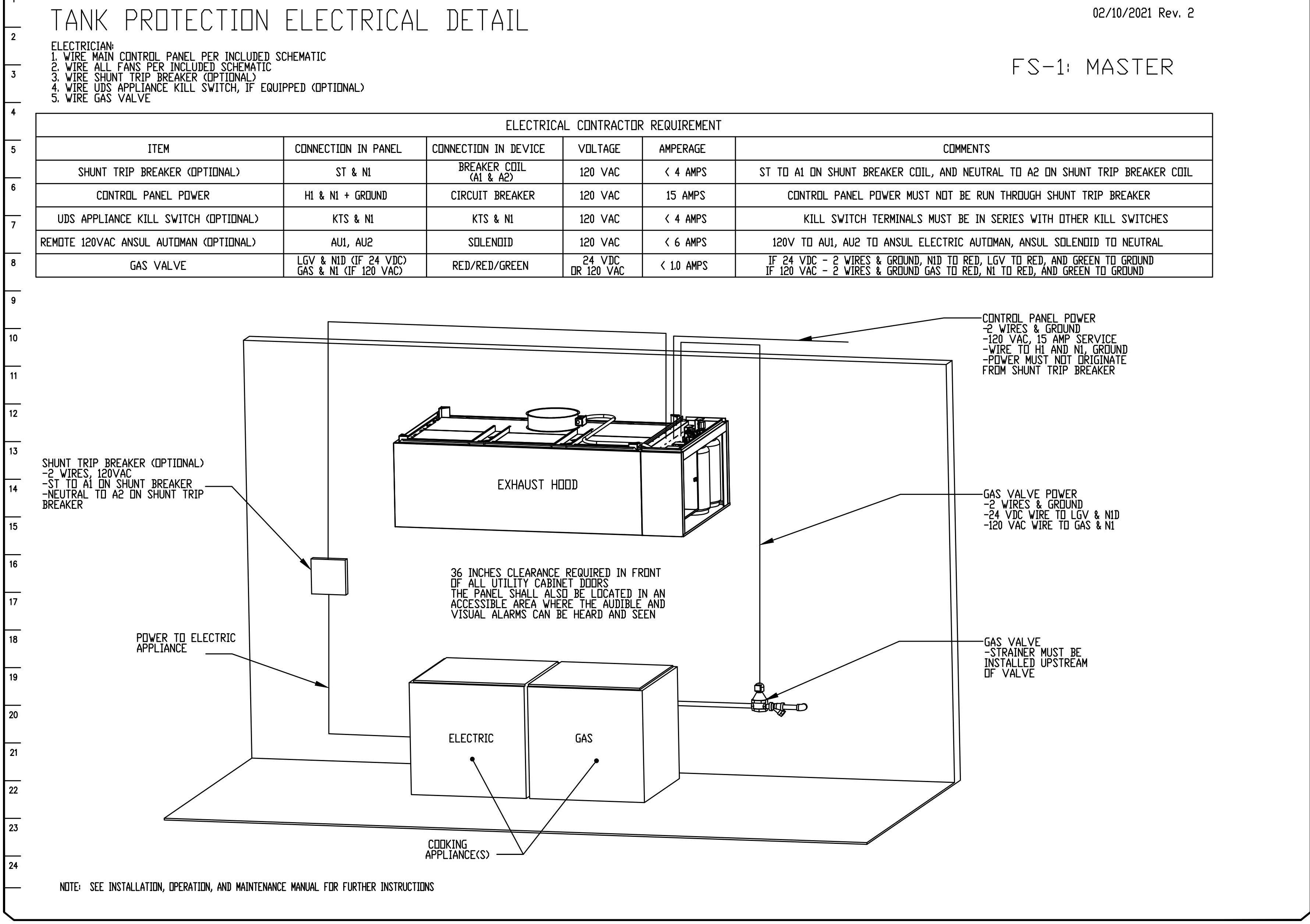
DRAWING NO:

M9

Exhaust Fan Wiring	JOB 7649475 - Restaurant - 3313 Superior Cr...
DRAWING NUMBER EXH7649475-1	SHIP DATE 7/22/2025
MODEL D088BFA	Installed Options



JOB NO 7649475	MODEL NUMBER SC-21110MA	DRAWN BY	SCHEMATIC TYPE INSTALL	DESCRIPTION OF OPERATION: Fire System #1 TANK FS - 4.0
JOB NAME Restaurant - 3313 Superior Cr...	DATE 7/22/2025	DWG NO	ECF #1-3	



APPROVED BY:

PROFESSIONAL ENGINEER
MANPREET SINGH
100201525
25-08-05
PROVINCE OF ONTARIO

CLIENT:

CONSULTANT:

PROBUILD ENGINEERING

50 Shandon Dr.,
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info@ProBuildEngineering.ca

PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
3313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:

FIRE SUPPRESSION
SYSTEM DETAIL #2

PROJECT NO:

MK-2025-03

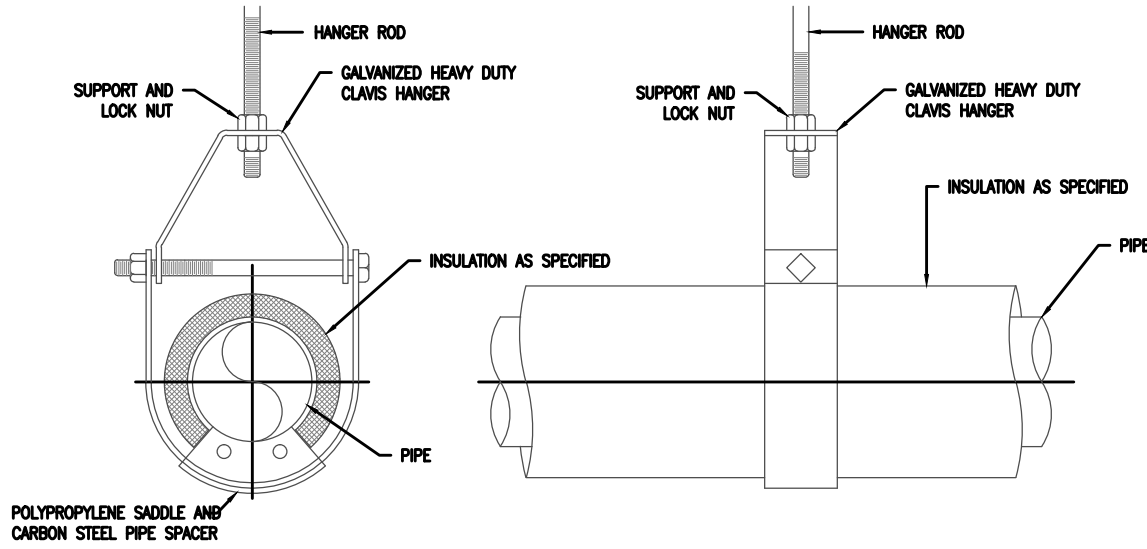
FILE NO:

PBE-25-03

DATE: MAY 2025
SCALE: AS NOTED
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CHECKED BY: MSK

DRAWING NO:

M10

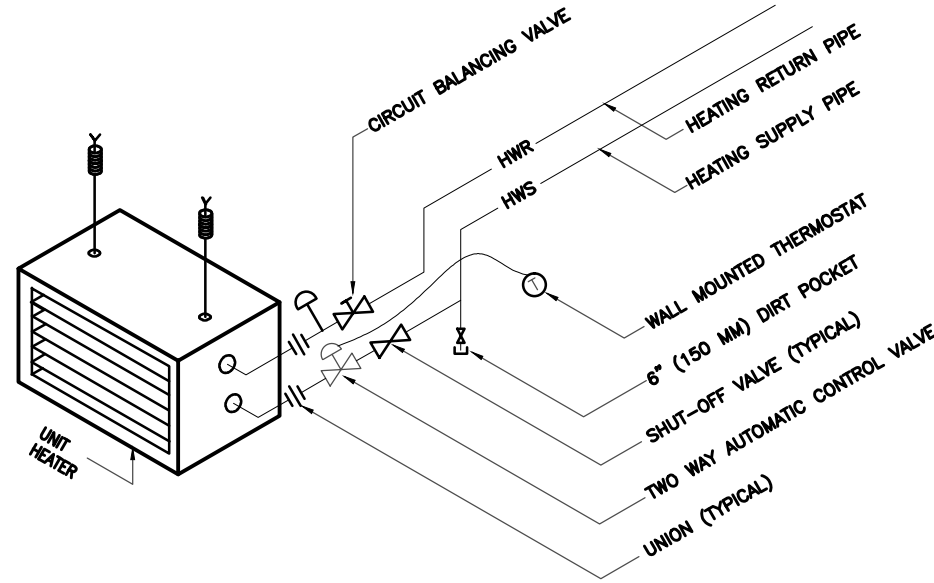


HANGER ROD SIZES				
PIPE SIZE	UP TO 2" (50)	2 1/2" - 3" (63-75)	4" - 5" (100-125)	6" - 12" (150-300)
HANGER ROD DIAMETER	3/8" (9.5)	1/2" (12)	5/8" (15.87)	3/4" (20)

HANGER SPACING												
PIPE SIZE	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"
SIZE	(25)	(32)	(38)	(50)	(63.5)	(75)	(100)	(125)	(150)	(200)	(250)	(300)
MAXIMUM SPACING	7' (2133)	8' (2438)	9' (2743)	10' (3000)	11' (3353)	12' (3657)	14' (4267)	16' (4876)	17' (5181)	19' (5791)	22' (6705)	23' (7010)

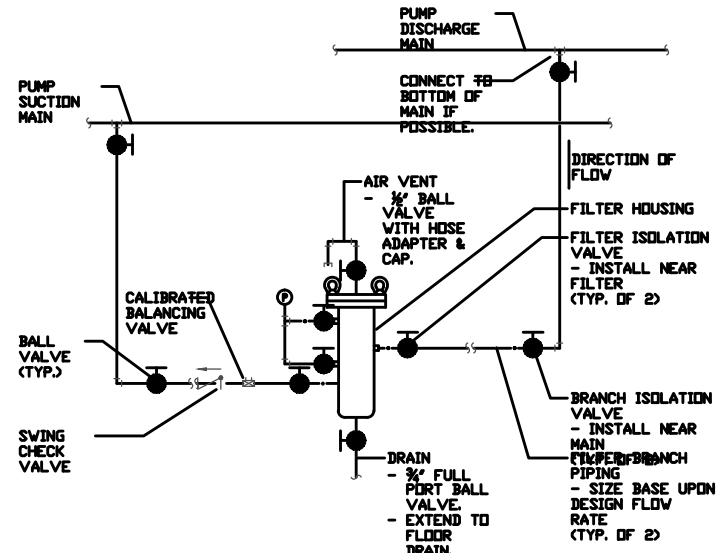
UNIT: IMPERIAL

PIPE HANGER DETAIL
N.T.S.



UNIT HEATER W/ 2-WAY CONTROL VALVE PIPING SCHEMATIC
N.T.S.

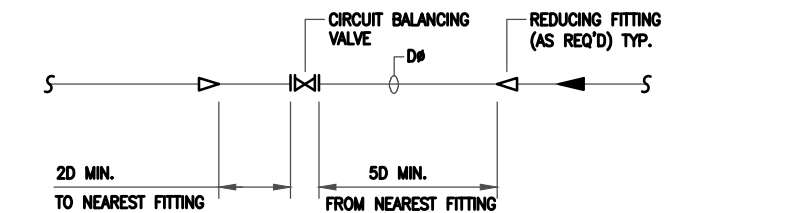
NOTES:
1. PROVIDE PREFABRICATED SUPPORT LESS AS REQUIRED FOR ADEQUATE SUPPORT DET. SHOW



BYPASS FILTRATION PIPING DETAIL
N.T.S.

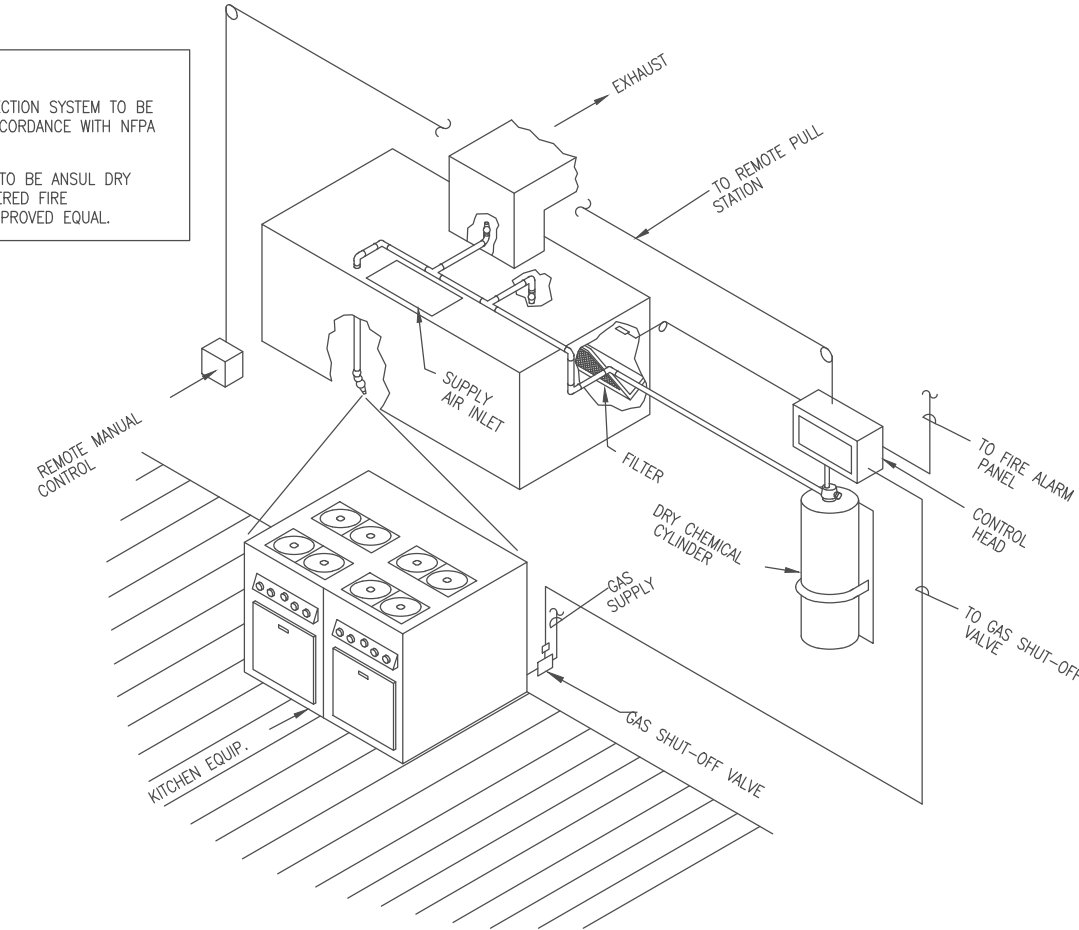
CIRCUIT BALANCING VALVE SCHEDULE (MPS/SA)			
SIZE	NOM FLOW (GPM)	MAX. GPM	
3/4"	UP TO 1	3.1	4.3
1"	3	6.9	9.6
1 1/4"	6.8	10.1	14.5
1 1/2"	10.2	16.2	24
1 3/4"	15	24	33
2"	25	40	55
2 1/2"	40	100	138
3"	95	145	200
4"	145	235	310
5"	230	320	500
6"	320	480	700
8"	500	900	1250

NOTE:
1. ABOVE SELECTION BASED ON TOUR & ANDERSSON: 1FT 4P @ MIN. 1 PSI (6.8MPa)
NOMINAL & 2 PSI (13.9 MPa) MAX AT FULL OPEN.
2. MECHANICAL CONTRACTOR MUST SIZE AND PROVIDE WATER CIRCUIT BALANCING VALVE AS PER SCHEDULE AND DETAIL.

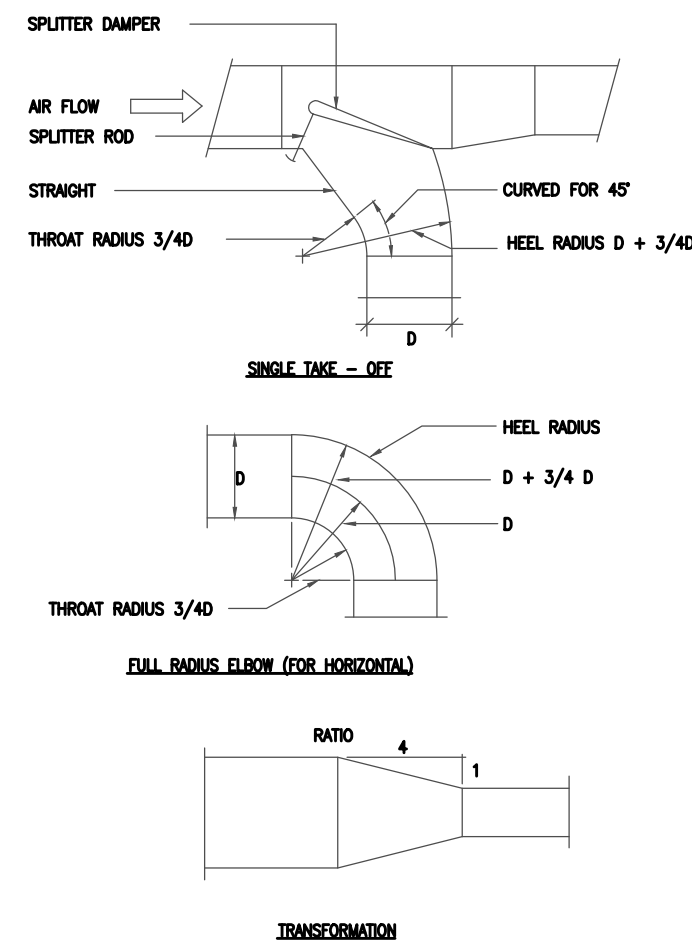


CIRCUIT BALANCING VALVE DETAIL & SCHEDULE
N.T.S.

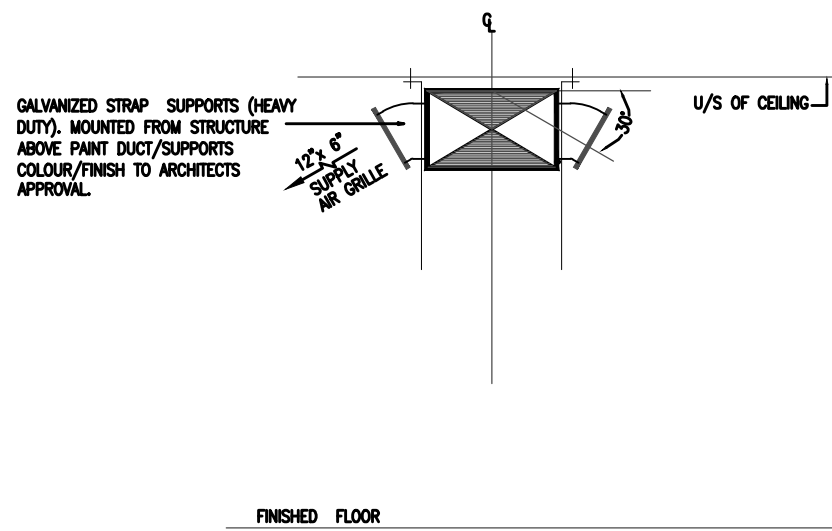
NOTES:
1. KITCHEN HOOD FIRE PROTECTION SYSTEM TO BE DESIGNED & INSTALLED IN ACCORDANCE WITH NFPA 96 AND NFPA 17A.
2. FIRE PROTECTION SYSTEM TO BE ANSUL DRY CHEMICAL, PRE-ENGINEERED FIRE SUPPRESSION SYSTEM, OR APPROVED EQUAL.



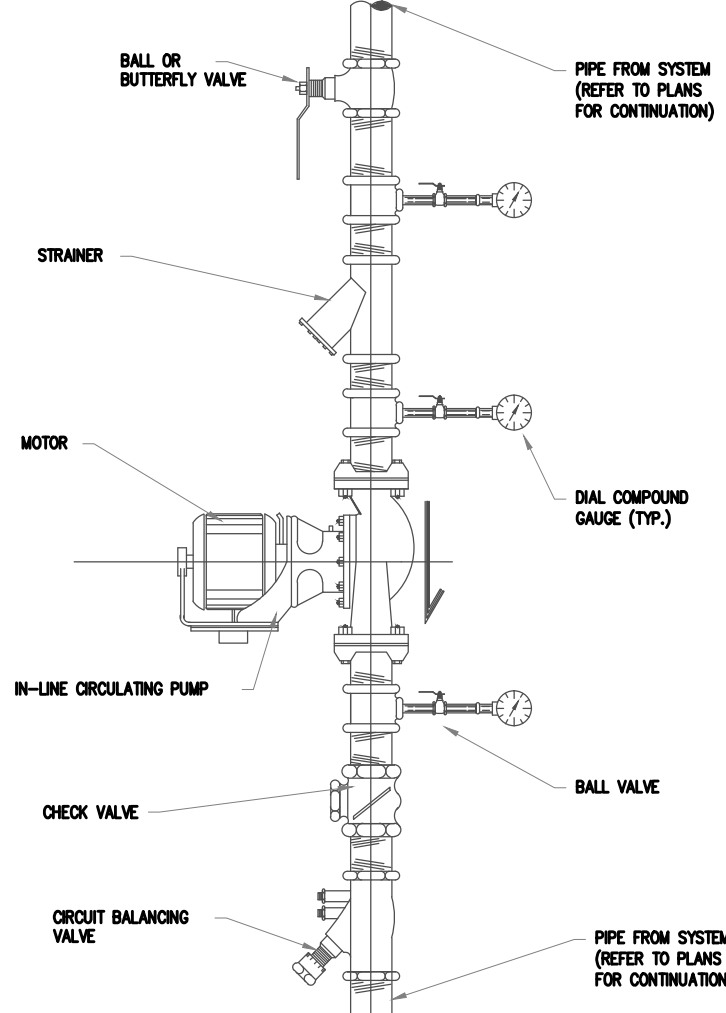
FIRE PROTECTION SYSTEM FOR KITCHEN EXHAUST HOOD
N.T.S.



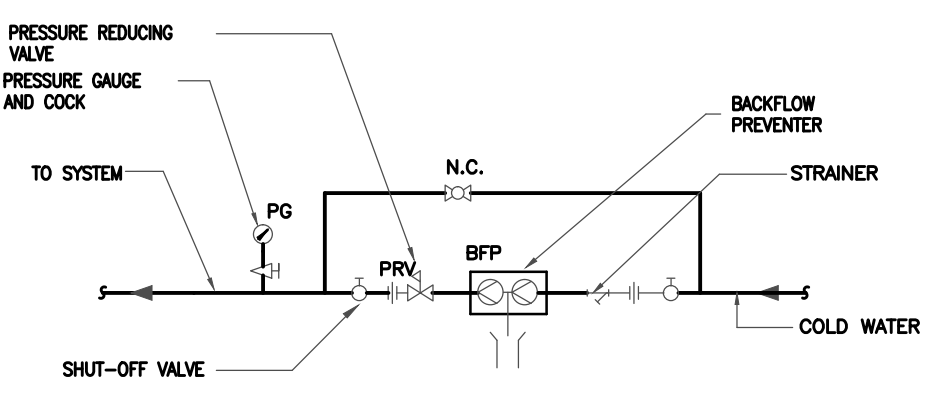
DUCT DETAILS
N.T.S.



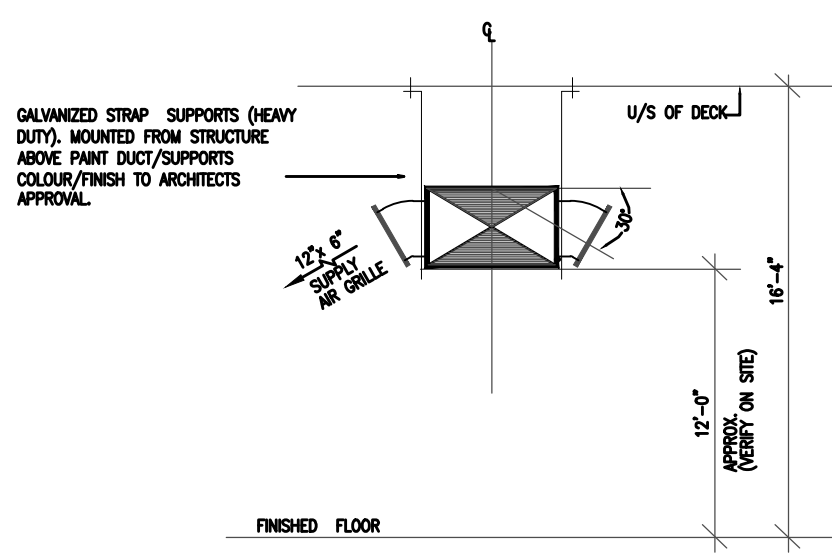
SQUARE DUCT WITH SIDEWALL GRILLES SHOWING MAIN DUCT
N.T.S.



IN-LINE CIRCULATING PUMP DETAIL
N.T.S.



MAKE-UP WATER ASSEMBLY
N.T.S.



SQUARE DUCT WITH SIDEWALL GRILLES SHOWING MAIN DUCT
N.T.S.

GENERAL NOTES:

CONTRACTOR TO CHECK DRAWINGS AND VERIFY DIMENSIONS ON THE JOB.
REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH CONSTRUCTION OR SHOP FABRICATION.
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APPROVED BY:



REV	DATE	NAME	DESCRIPTION
03	MAR.26.26	MSK	ISSUED FOR TENDER
02	JUN.11.25	MSK	ISSUED FOR REVIEW
01	MAY.23.25	MSK	ISSUED FOR REVIEW

CLIENT:

CONSULTANT:

PROBUILD ENGINEERING
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Toronto ON M1R 4M5, Canada
Tel: (416) 671-0054
www.ProBuildEngineering.ca
info@ProBuildEngineering.ca

PROJECT NAME:

BUILDING UPGRADES
BETHANY RESIDENCE
313 SUPERIOR CRT
UNIT B-107
OAKVILLE, ON

DRAWING TITLE:
MECHANICAL DETAILS

PROJECT NO.:
MK-2025-03

FILE NO.:
PBE-25-03

DATE: MAY 2025
SCALE: AS NOTED
DRAWN BY: IE
CHECKED BY: MSK

DRAWING NO.:
M11

ATTACHMENT B



Hazardous Building Materials Assessment (Management)

Bethany Residence
2387 Industrial Street,
Burlington, Ontario

Prepared for:

**The Regional Municipality of
Halton**

1151 Bronte Road
Oakville, Ontario L6M 3L1

July 12, 2023

Pinchin File: 321956.002



Hazardous Building Materials Assessment (Management)
Bethany Residence, 2387 Industrial Street, Burlington, Ontario
The Regional Municipality of Halton

July 12, 2023
Pinchin File: 321956.002

Issued to:	The Regional Municipality of Halton
Issued on:	July 12, 2023
Pinchin File:	321956.002
Issuing Office:	Hamilton, ON

A handwritten signature in black ink that reads "Justin Appleby".

Author: Justin Appleby, ADip.T.(Arch)
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A handwritten signature in blue ink that reads "Leslie Heywood".

Reviewer: Leslie Heywood, BEng Mgt
Senior Project Manager
289.237.4294
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EXECUTIVE SUMMARY

The Regional Municipality of Halton (Client) retained Pinchin Ltd. (Pinchin) to conduct a hazardous building materials assessment at Bethany Residence located at 2387 Industrial Street, Burlington, Ontario. Pinchin performed the assessment on March 6 and 14, 2023.

The objective of the assessment was to document the locations of specified hazardous 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:

- Texture coat
- Drywall joint compound
- Vinyl floor tiles
- Vinyl sheet flooring
- All asbestos-containing materials were observed to be in good condition.

Lead:

- Batteries of emergency lights contain solid lead.

Silica: Crystalline silica is present in concrete and other materials such as masonry, drywall, and plaster.

Mercury: Mercury vapour is present in lamp tubes.

Polychlorinated Biphenyls (PCBs): Based on the date of construction, PCBs may be present in light ballasts.

Mould and Water Damage: Visible mould and water damage was not observed.



SUMMARY OF RECOMMENDATIONS

The following is a summary of significant recommendations; refer to the body of the report for detailed recommendations.

1. Prepare an Asbestos Management Program (AMP).
2. Perform a reassessment of ACM on an annual basis.
3. Perform a pre-construction assessment prior to commencing renovations or demolition.
4. Remove and properly dispose of PCB ballasts when fixtures are decommissioned. All PCB lamp ballasts must be removed from service and properly disposed of by December 31, 2025.
5. Recycle mercury-containing lamp tubes and thermostats when removed from service.
6. Follow appropriate safe work procedures when handling or disturbing asbestos, lead, silica, and mould.

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.



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APPENDICES

APPENDIX I	Drawings
APPENDIX II-A	Asbestos Analytical Certificates
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APPENDIX III	Methodology and Evaluation Criteria
APPENDIX IV	Location Summary Report
APPENDIX V	Hazardous Materials Summary Report / Sample Log
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1.0 INTRODUCTION AND SCOPE

The Regional Municipality of Halton (Client) retained Pinchin Ltd. (Pinchin) to conduct a hazardous building materials assessment at Bethany Residence located at 2387 Industrial Street, Burlington, Ontario.

Pinchin performed the assessment on March 6, 2023 with a return date on March 14th. The assessor was accompanied by a maintenance staff member during the assessment. The assessed area was occupied at the time of the assessment.

The objective of the assessment was to document the locations of specified hazardous 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 **assessed area** consisted of all interior areas of the building; the exterior of the building was not included.

The assessment was performed to establish the type of specified hazardous building materials, locations and approximate quantities incorporated in the structure(s) and its finishes.

For the purpose of the assessment and this report, hazardous building materials are defined as follows:

- Asbestos
- Lead
- Silica
- Mercury
- Polychlorinated Biphenyls (PCBs)
- Mould

The following Designated Substances are not typically found in building materials in a composition/state that is hazardous and were not included in this assessment:

- Arsenic
- Acrylonitrile
- Benzene
- Coke oven emissions



- Ethylene oxide
- Isocyanates
- Vinyl chloride monomer

2.0 METHODOLOGY

Pinchin conducted a room-by-room assessment (rooms, corridors, service areas, exterior, etc.) to identify the hazardous 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. Destructive testing of flooring was conducted (under carpets or multiple layers of flooring). Demolition of walls, solid ceilings, structural items, interior finishes, or exterior building finishes, to determine the presence of concealed materials was not conducted. Sampling of roofing materials was not conducted.

For further details on the methodology including test methods and evaluation criteria, refer to Appendix III.

3.0 BACKGROUND INFORMATION

3.1 Building Description

Description Item	Details
Use	Residence
Number of Floors	The building is 2 storeys plus 1 level below grade.
Total Area	The total area of the building is 18,836 square feet.
Year of Construction	1970 - Apartment and House 1986 - ACLF Building 1992 - Main Building 1997 - Link Building
Structure	Metal
Exterior Cladding	Brick, wood, and metal
HVAC	Radiant heating
Roof	Not assessed
Flooring	Vinyl sheet flooring, vinyl floor tiles, and ceramic tiles
Interior Walls	Drywall and masonry
Ceilings	Drywall and acoustic ceiling tiles

3.2 Existing Reports

No existing reports were provided for reference.



3.3 Inaccessible Locations

The following rooms or areas were not accessible and are therefore not included in the report:

Area or Room	Loc. No.	Reason
Dining Room Attic	14	Limited access
Office Attic	15	Limited access
Tenant Spaces	16	Not assessed because caretakers were working with occupants
Tenant Spaces	17	Not assessed because caretakers were working with occupants

4.0 FINDINGS

The following section summarizes the findings of the assessment and provides a general description of the hazardous building materials identified. For details on approximate quantities, condition, friability, accessibility, and locations of hazardous building materials; refer to the Hazardous Material Summary / Sample Log and All Data Report in Appendices V and VI.

Any quantities listed in this report or data tables are estimated based on visual approximations only and are subject to variation.

4.1 Asbestos

4.1.1 Spray-Applied Insulation

Spray-applied fireproofing and overspray present on the structure throughout the Main Building is presumed to not contain asbestos based on the date of construction (1992, Photo 1).



Photo 1



4.1.2 *Texture Finishes (Decorative)*

Texture finish, containing asbestos, is present on drywall ceilings throughout the ACLF basement and ground floor (Locations 16, 17, 18, and 19, Samples S0005A-E).

Texture finish, containing asbestos, is present on drywall ceilings throughout the Apartment (Location 22, Samples S0015A-E, Photo 1).



Photo 1

4.1.3 *Pipe Insulation*

Pipes in the assessed area are either uninsulated or insulated with non-asbestos fibreglass or other non-asbestos insulation such as mineral fibre or elastomeric foam insulation.

Pipes insulated with asbestos-containing insulations may be present in inaccessible spaces such as above solid ceilings, in chases, in column enclosures and within shafts in the Apartment and House.

4.1.4 *Duct Insulation and Mastic*

Ducts are either uninsulated or insulated with non-asbestos fibreglass (foil-faced or canvas jacketing).

4.1.5 *Mechanical Equipment Insulation*

Mechanical equipment (i.e., furnace, hot water tanks, boilers) is either uninsulated or insulated with non-asbestos fibreglass.

4.1.6 *Acoustic Ceiling Tiles*

Ceiling tiles are presumed to be non-asbestos based on the age of the materials determined from the age of the building construction or the date stamps applied to the top of the tiles. The tiles were manufactured after asbestos stopped being used in acoustic ceiling tiles.



4.1.7 Plaster

Plaster present on walls and ceilings throughout the House does not contain asbestos (Samples S0006A-E, Photo 1).

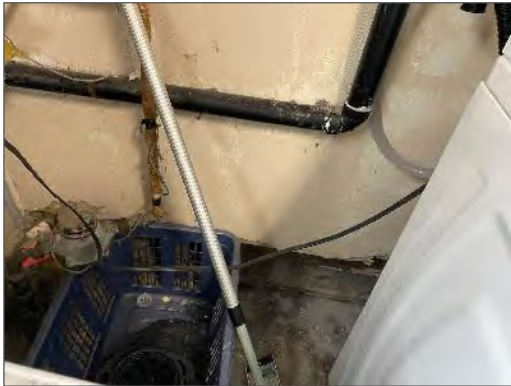


Photo 1

4.1.8 Drywall Joint Compound

Drywall joint compound present on wall and ceiling finishes throughout the assessed area throughout the ACLF basement, ground floor and first floor does not contain asbestos (Samples S0004A-E).

Drywall joint compound, containing asbestos, is present on wall and ceiling finishes throughout the Apartment (Location 22, Samples S0016A-E, Photo 1).

Asbestos in drywall joint compound was banned in Canada in 1980. Drywall joint compound in the Main Building and the Link Building was installed on or after 1992 and is presumed to contain no asbestos.

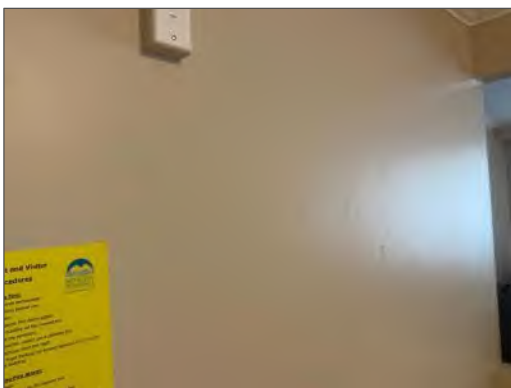


Photo 1


Hazardous Building Materials Assessment (Management)

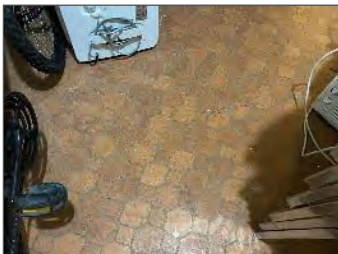
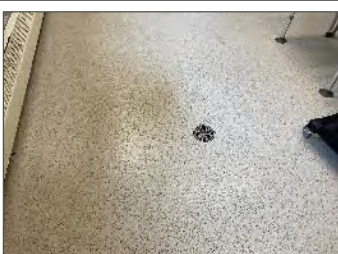
Bethany Residence, 2387 Industrial Street, Burlington, Ontario
The Regional Municipality of Halton

July 12, 2023

Pinchin File: 321956.002

4.1.9 Vinyl Sheet Flooring

The following is a summary of vinyl sheet flooring sampled, for a complete list of locations, refer to Appendix V.

Description	Sample Location (Loc #)	Sample Number or Material Composition	Asbestos (Backing / Adhesive)	Photo
Red and brown peel and stick	Special Care Ground Floor (Location 2)	S0011A-C	No / No	
Beige peel and stick	Special Care Second Floor (Location 4)	S0013A-C	No / No	
Ceramic tiles look peel and stick	ACLF Basement (Location 17)	S0014A-C	Yes / Presumed	
Beige with black spots	Not sampled	Not sampled (Rubber)	No	


Hazardous Building Materials Assessment (Management)

Bethany Residence, 2387 Industrial Street, Burlington, Ontario
The Regional Municipality of Halton

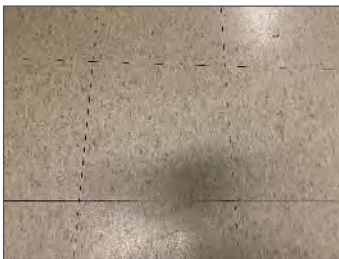
July 12, 2023

Pinchin File: 321956.002

Description	Sample Location (Loc #)	Sample Number or Material Composition	Asbestos (Backing / Adhesive)	Photo
Grey with black spots	Not sampled	Not sampled (Rubber)	No	

4.1.10 Vinyl Floor Tiles

The following is a summary of vinyl floor tiles sampled, for a complete list of locations, refer to Appendix V.

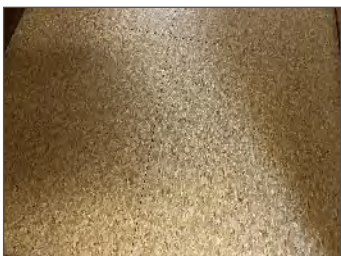
Description	Sample Location (Location #)	Sample Number	Asbestos (Tile / Adhesive)	Photo
12"x12", beige with orange streaks	Main Building Basement (Location 6)	S0001A-C	No / No	
12"x12", grey with black streaks	Main Building Basement (Location 6)	S0002A-C	No / No	
12"x12", pink with white fleck	ACLF Lounge Med Room (Location 19) Special Care Ground Floor (Location 2)	S0003A-C	No / No	


Hazardous Building Materials Assessment (Management)

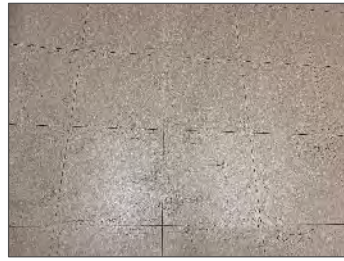
Bethany Residence, 2387 Industrial Street, Burlington, Ontario
The Regional Municipality of Halton

July 12, 2023

Pinchin File: 321956.002

Description	Sample Location (Location #)	Sample Number	Asbestos (Tile / Adhesive)	Photo
	Main Building Ground Floor (Location 1)			
Black with white spots	House (Location 23)	S0007A-C	Yes / Presumed	
12"x12", white with black streaks	Apartment (Location 22)	S0008A-C	Yes / No	
12"x12", grey with black and white fleck	Main Building Ground Floor (Location 1)	S0009A-C	No / No	
12"x12", brown with white, light brown, and dark brown fleck	Main Building Ground Floor (Location 1)	S0010A-C	No / No	
12"x12", blue with white and grey streak	Main Building Dining Offices (Location 3)	S0012A-C	No / No	



Description	Sample Location (Location #)	Sample Number	Asbestos (Tile / Adhesive)	Photo
12"x12", beige	Elevator (Location 9)	Not sampled	No	

Vinyl floor tiles were presumed to be non-asbestos based on historical knowledge of the date of installation (1997).

4.1.11 Excluded 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 felts and tar, mastics
- Floor levelling compound
- Ceramic tile setting compound
- Elevator and lift brakes
- Electrical components
- Mechanical packing, ropes, and gaskets
- Vermiculite
- Caulking and putties
- Fibre-reinforced paints and coatings
- Fire resistant doors
- Metal clad finishes (Galbestos)
- Terrazzo
- Sealants on pipe threads

4.2 Lead

4.2.1 Paints and Surface Coatings

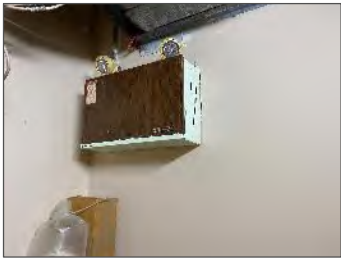
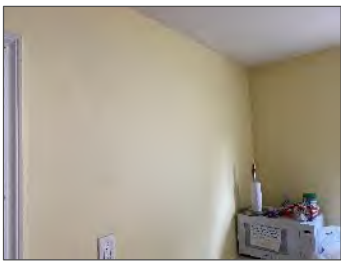
The following table summarizes the analytical results of paints sampled.


Hazardous Building Materials Assessment (Management)

Bethany Residence, 2387 Industrial Street, Burlington, Ontario
The Regional Municipality of Halton

July 12, 2023

Pinchin File: 321956.002

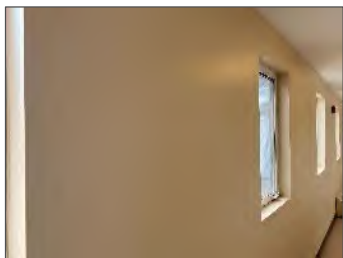
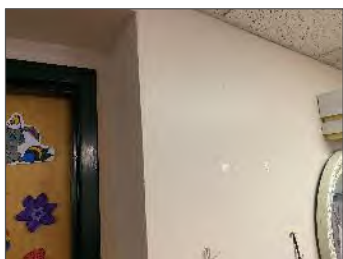
Sample Number	Colour, Substrate Description	Sample Location	Lead (%)	Photo
L0001	Pink, concrete block	Main Building (Location 6)	<0.0036	
L0002	Green, concrete block	Main Building (Location 6)	0.0068	
L0003	White, drywall walls/ceilings	ACLF Lounge Med Room (Location 19)	0.0039	
L0004	Pink, drywall walls	ACLF Lounge Med Room (Location 19)	<0.0026	
L0005	Grey, drywall walls	Special Care Second Floor (Location 4)	<0.0041	N/A
L0006	Yellow, drywall walls	House (Location 23)	<0.0069	


Hazardous Building Materials Assessment (Management)

Bethany Residence, 2387 Industrial Street, Burlington, Ontario
The Regional Municipality of Halton

July 12, 2023

Pinchin File: 321956.002

Sample Number	Colour, Substrate Description	Sample Location	Lead (%)	Photo
L0007	Blue, drywall walls	Special Care Ground Floor (Location 2)	<0.0067	
L0008	Beige, drywall walls	Main Building Ground Floor (Location 1)	<0.0068	
L0011	Beige, drywall walls	Link (Location 21)	<0.0054	
L0012	Pink, drywall walls and ceilings	Main Building Ground Floor (Location 1)	<0.0078	
L0013	White, drywall ceilings	Main Building Dining Offices (Location 3)	<0.0063	N/A
L0014	White, drywall ceilings	Apartment (Location 22)	<0.0042	

All paints sampled were below the threshold of 0.009% (90 mg/kg).



4.2.2 Lead Products and Applications

Lead-containing batteries are present in emergency lighting (Photo 1).



Photo 1

4.2.3 Excluded Lead Materials

Lead is known to be present in several materials which were not assessed or sampled. The following materials, where found, should be presumed to contain lead.

- Electrical components, including wiring connectors, grounding conductors, and solder
- Solder on pipe connections
- Glazing on ceramic tiles
- Lead shielding

4.3 Silica

Crystalline silica is assumed to be a component of the following materials where present in the building.

- Concrete
- Masonry and mortar
- Ceramic tiles and grout
- Plaster
- Drywall
- Ceiling tiles



4.4 Mercury

4.4.1 Lamps

Mercury vapour is present in fluorescent lamp tubes.

4.4.2 Mercury-Containing Devices

Thermostats inspected did not contain liquid mercury ampules.

Mercury-containing devices were not found during the assessment.

4.5 Polychlorinated Biphenyls

4.5.1 Lighting Ballasts

The building has not been comprehensively re-lamped with energy efficient light fixtures (evidence of T-12 fixtures), and as such, a percentage of light ballasts may be manufactured prior to 1980 and may contain PCBs.

4.5.2 Transformers

All transformers in the building are dry type transformers and do not contain PCB-containing dielectric fluids; however, may contain capacitors, which could not be assessed for PCBs as the equipment was in service.

4.5.3 Excluded PCB Materials

PCBs are known to be present in several materials and equipment which were not assessed or sampled. The following materials, where found, should be presumed to contain PCBs until sampling proves otherwise.

- Capacitors within or associated with electrical equipment
- Oil impregnated cables
- High voltage electrical terminals (potheads) and bushings
- Voltage regulators and capacitors
- Hydraulic fluids
- Paints
- Lubricants

4.6 Mould and Water Damage

Visible mould growth and water damage was not found during the assessment.



5.0 RECOMMENDATIONS

5.1 General

This report does not provide sufficient detail for most renovation or demolition. 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 sampling of other materials not previously tested (e.g., roofing materials, caulking, mastics).

5.2 On-going Management and Maintenance

The following recommendations are made regarding on-going management and maintenance work involving the hazardous materials identified.

5.2.1 Asbestos

Prepare an Asbestos Management Program (AMP). The AMP should address and document: written work practices, worker training, notifications, policies, and responsibilities.

Perform a reassessment of asbestos-containing materials (ACM) on an annual basis.

Remove ACM prior to alteration or maintenance work if ACM may be disturbed by the work. Follow appropriate asbestos precautions for the classification of work being performed.

Asbestos-containing materials must be disposed of at a landfill approved to accept asbestos waste.

Update the asbestos inventory upon completion of the abatement and removal of asbestos-containing materials and any other relevant findings.

5.2.2 Lead

Lead-containing items should be recycled when taken out of service.

5.2.3 Silica

Disturbance of silica-containing products during maintenance activities may result in excessive exposures to airborne silica, especially if performed indoors and dry. Cutting, grinding, drilling or demolition of materials containing silica should be completed only with proper respiratory protection and other worker safety precautions that comply with applicable regulations and guidelines.

5.2.4 Mercury

Do not break lamps or separate liquid mercury from components.


Hazardous Building Materials Assessment (Management)

Bethany Residence, 2387 Industrial Street, Burlington, Ontario
The Regional Municipality of Halton

July 12, 2023

Pinchin File: 321956.002

5.2.5 PCBs

When light fixtures are removed from service, examine light ballasts for PCB content. If ballasts are not clearly labelled as “non-PCB” or are suspected to contain PCBs; package and ship ballasts for destruction at a federally permitted facility. All ballasts that contain PCBs must be removed from service and disposed of by December 31, 2025.

Sample caulking for PCB content prior to disturbance.

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 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. Lead on Construction Projects, Ministry of Labour Guidance Document.
4. The Environmental Abatement Council of Canada (EACC) Lead Guideline for Construction, Renovation, Maintenance or Repair.
5. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 347 as amended.
6. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 362 as amended.
7. Silica on Construction Projects, Ministry of Labour Guidance Document.
8. Alert – Mould in Workplace Buildings, Ontario Ministry of Labour.
9. PCB Regulations, SOR/2008-273, Canadian Environmental Protection Act.
10. Surface Coating Materials Regulations, SOR/2016-193, Canada Consumer Product Safety Act.

**Hazardous Building Materials Assessment (Management)**

Bethany Residence, 2387 Industrial Street, Burlington, Ontario
The Regional Municipality of Halton

July 12, 2023

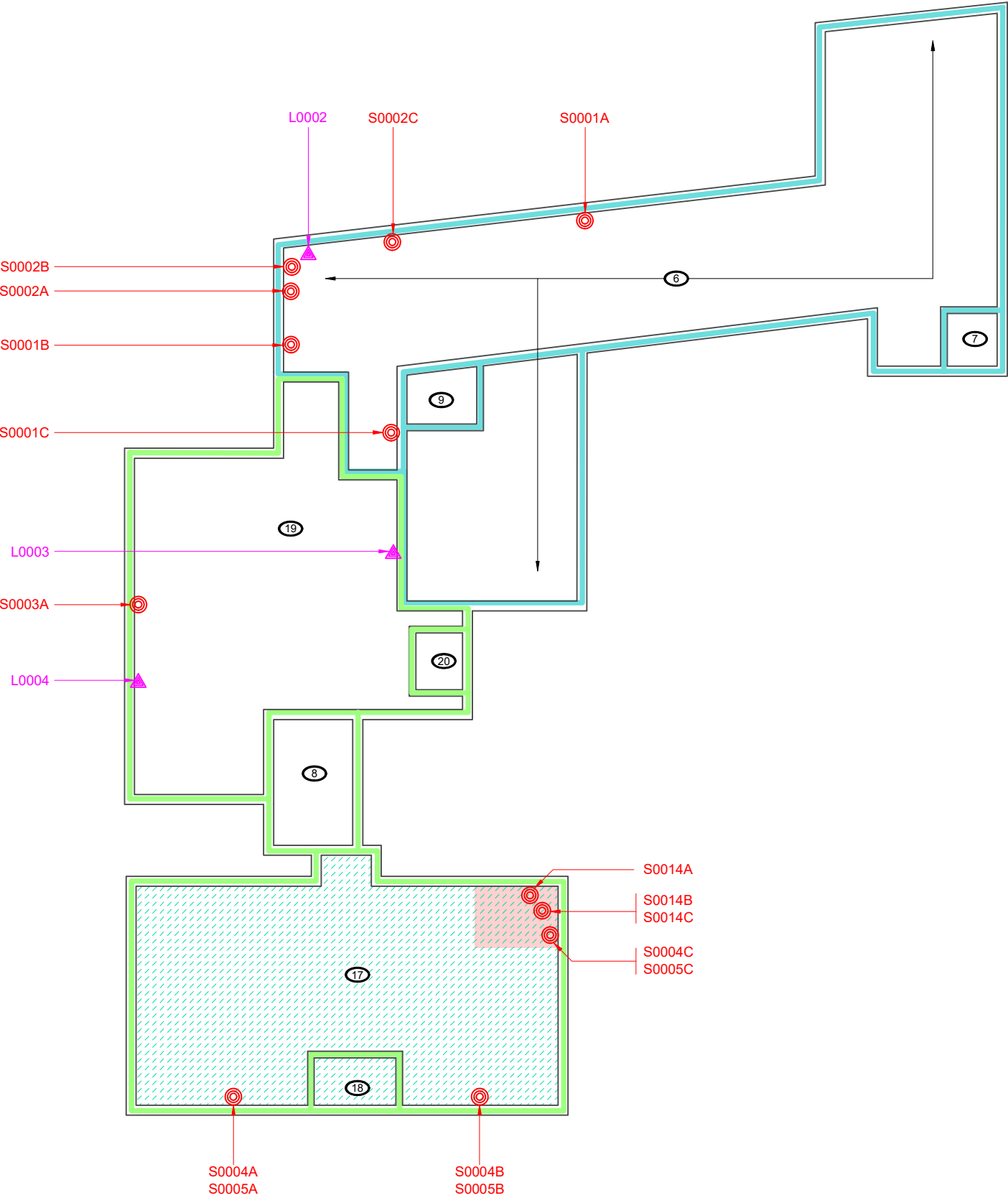
Pinchin File: 321956.002

11. Consolidated Transportation of Dangerous Goods Regulations, including Amendment SOR/2019-101, Transportation of Dangerous Goods Act.
12. Mould Guidelines for the Canadian Construction Industry, Standard Construction Document CCA 82 – 2004 (Revised 2018), Canadian Construction Association.

\\pinchin.com\miss\Job\321000s\0321956.000 RMofHalton,2387IndustrialSt,BSS,BCA\0321956.002 RMofHalton,2387IndustrialSt,HAZ,ASSMT\Deliverables\321956.002 Final HBMA Report 2387 Industrial St Burlington ON July 12 2023.docx

Template: Master Report for Hazardous Materials Assessment Report (Management), HAZ, October 31, 2022

APPENDIX I
Drawings



LEGEND

- PINCHIN LOCATION NUMBER
- ASBESTOS BULK SAMPLE
- LEAD BULK SAMPLE
- 1992 PHASE OF CONSTRUCTION
- 1997 PHASE OF CONSTRUCTION
- 1970 PHASE OF CONSTRUCTION
- 1986 PHASE OF CONSTRUCTION
- ASBESTOS-CONTAINING MATERIALS:
 - TEXTURE FINISH
 - VINYL SHEET FLOORING
 - 9"x9" VINYL FLOOR TILES
 - 12"x12" VINYL FLOOR TILES

NOT ALL KNOWN OR SUSPECTED HAZARDOUS BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE HAZARDOUS BUILDING MATERIALS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED HAZARDOUS BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.



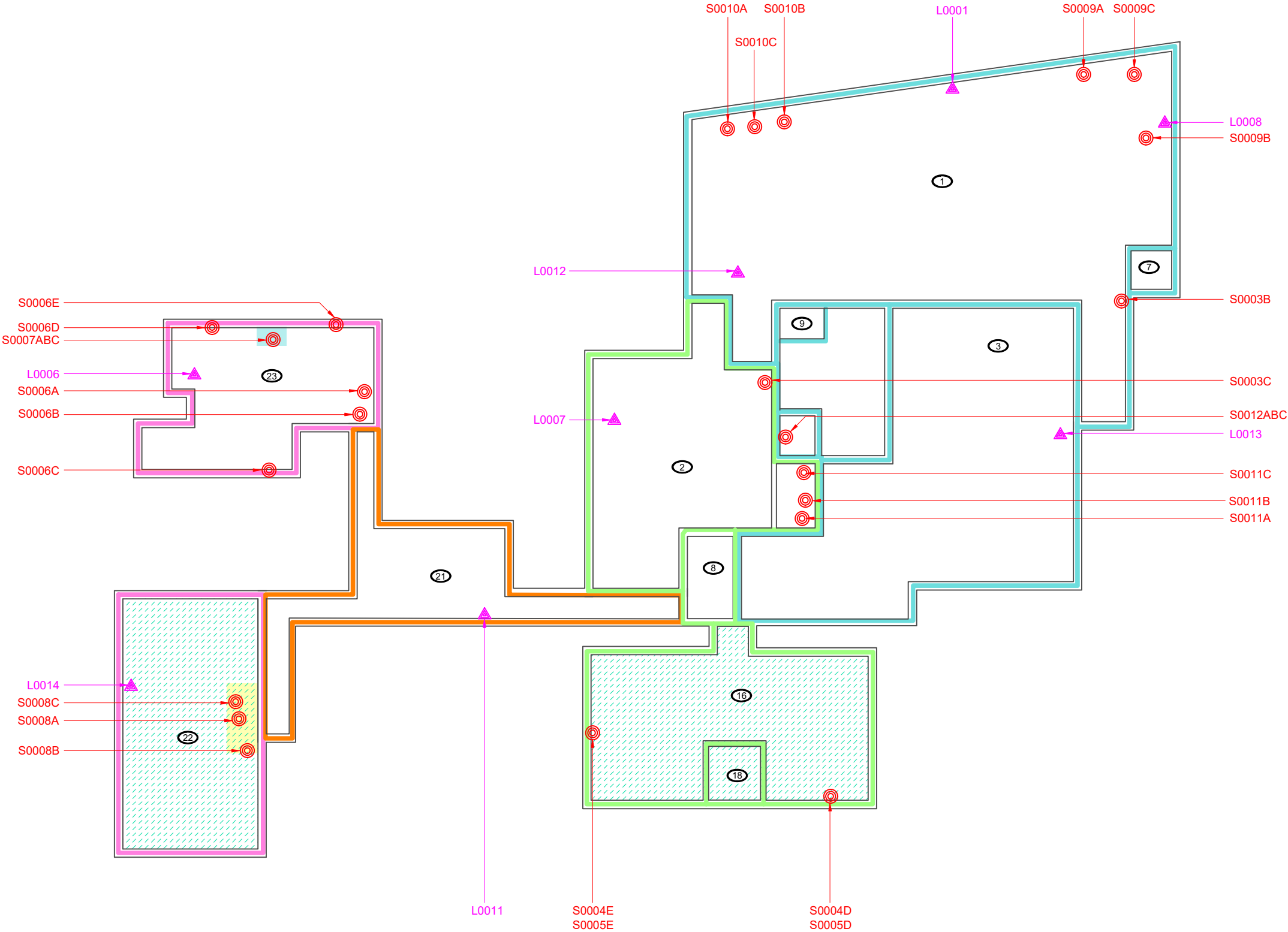
PROJECT NAME:
HAZARDOUS BUILDING MATERIALS ASSESSMENT

CLIENT NAME:
HALTON

PROJECT LOCATION:
2387 INDUSTRIAL STREET,
BURLINGTON, ON

FIGURE NAME:
BASEMENT

PROJECT NUMBER: 321956.002	SCALE: NOT TO SCALE
DRAWN BY: NL.	REVIEWED BY: JA
DATE: MARCH 2023	FIGURE NUMBER: 1 OF 4



PROJECT NAME:
HAZARDOUS BUILDING
MATERIALS ASSESSMENT

CLIENT NAME:
HALTON

PROJECT LOCATION:
2387 INDUSTRIAL STREET,
BURLINGTON, ON

FIGURE NAME:
GROUND FLOOR

PROJECT NUMBER:
321956.002

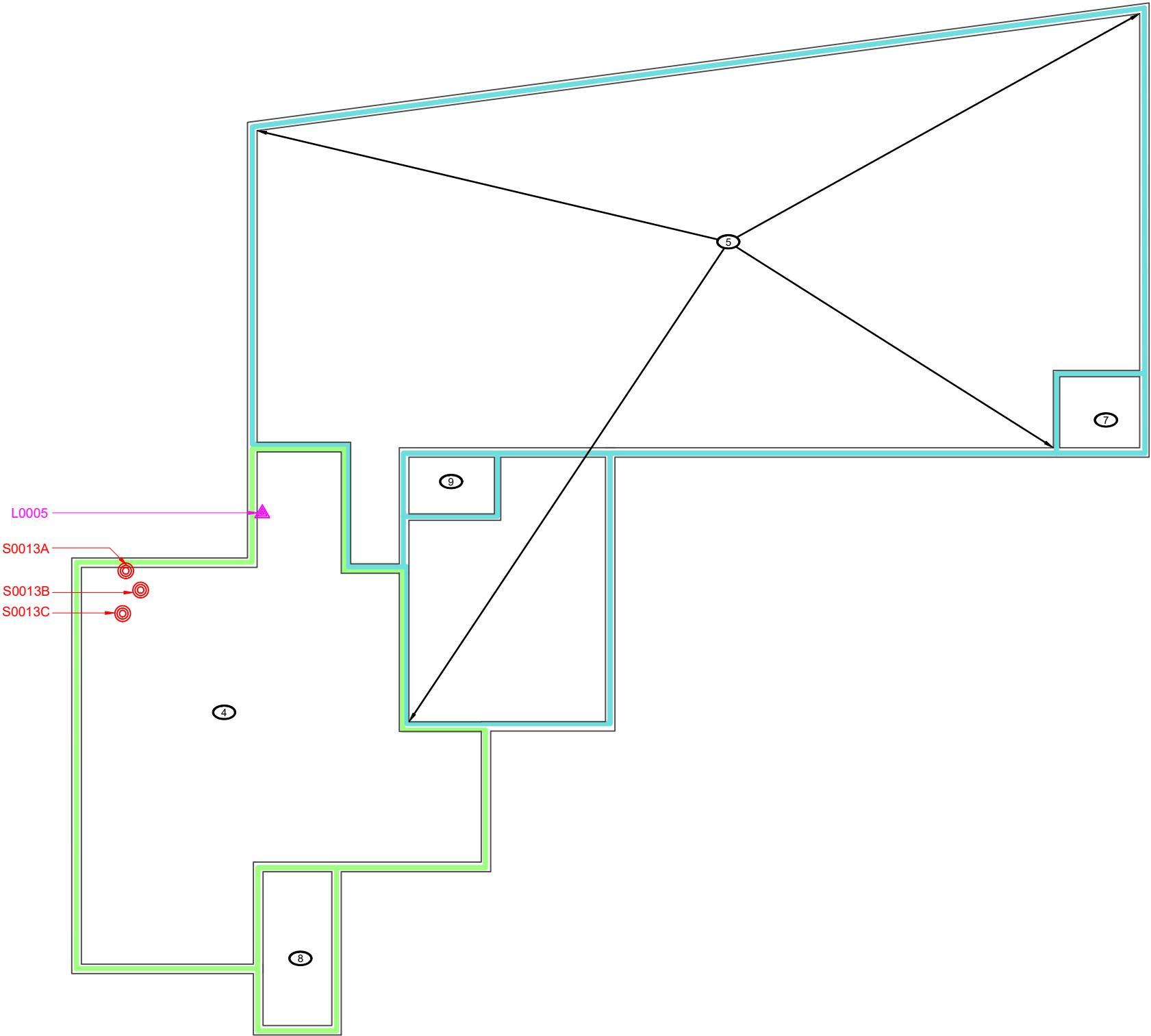
SCALE:
NOT TO SCALE

DRAWN BY:
NL.

REVIEWED BY:
JA

DATE:
MARCH 2023

FIGURE NUMBER:
2 OF 4



LEGEND

- PINCHIN LOCATION NUMBER
- ASBESTOS BULK SAMPLE
- LEAD BULK SAMPLE
- 1992 PHASE OF CONSTRUCTION
- 1997 PHASE OF CONSTRUCTION
- 1970 PHASE OF CONSTRUCTION
- 1986 PHASE OF CONSTRUCTION
- ASBESTOS-CONTAINING MATERIALS:
 - TEXTURE FINISH
 - VINYL SHEET FLOORING
 - 9"x9" VINYL FLOOR TILES
 - 12"x12" VINYL FLOOR TILES

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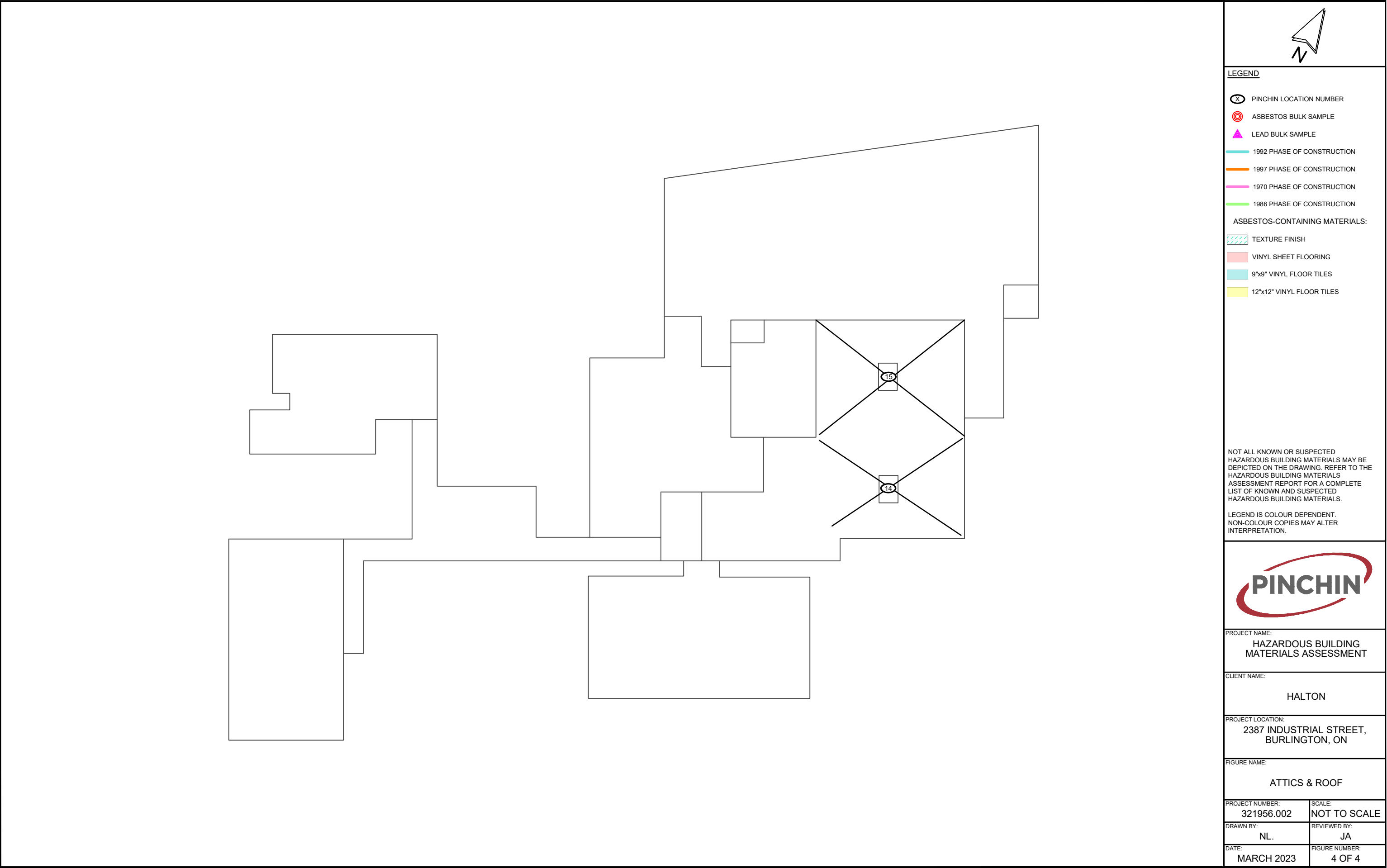
PROJECT NAME:
HAZARDOUS BUILDING MATERIALS ASSESSMENT

CLIENT NAME:
HALTON

PROJECT LOCATION:
2387 INDUSTRIAL STREET,
BURLINGTON, ON

FIGURE NAME:
SECOND FLOOR

PROJECT NUMBER: 321956.002	SCALE: NOT TO SCALE
DRAWN BY: NL.	REVIEWED BY: JA
DATE: MARCH 2023	FIGURE NUMBER: 3 OF 4



PROJECT NAME:
HAZARDOUS BUILDING MATERIALS ASSESSMENT

CLIENT NAME:
HALTON

PROJECT LOCATION:
2387 INDUSTRIAL STREET,
BURLINGTON, ON

FIGURE NAME:
ATTICS & ROOF

PROJECT NUMBER: 321956.002	SCALE: NOT TO SCALE
DRAWN BY: NL.	REVIEWED BY: JA
DATE: MARCH 2023	FIGURE NUMBER: 4 OF 4

APPENDIX II-A
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: 10018043

Analysis: PLM

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0001A - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Beige With Orange Streaks, Loc:6, Main Building Basement	None Detected		100% Other	Beige
10018043_0001	tile				Non-Fibrous Homogeneous Crushed
S0001A - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Beige With Orange Streaks, Loc:6, Main Building Basement	None Detected	5% Cellulose	95% Other	Black, Yellow
10018043_0043	mastic				Non-Fibrous Homogeneous Crushed, Dissolved
S000-1A - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Beige With Orange Streaks, Loc:6, Main Building Basement	None Detected		100% Other	Beige
10018043_0002	mastic; bag labeled as 1-B				Non-Fibrous Homogeneous Crushed
S000-1A - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Beige With Orange Streaks, Loc:6, Main Building Basement	None Detected	5% Cellulose	95% Other	Black, Yellow
10018043_0044	mastic; bag labeled as 1-B				Non-Fibrous Homogeneous Dissolved, Crushed
S0001B - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Beige With Orange Streaks, Loc:6, Main Building Basement	None Detected		100% Other	Beige
10018043_0003	tile-ashed; bag labeled as 1-C				Non-Fibrous Homogeneous Ashed
S0001B - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Beige With Orange Streaks, Loc:6, Main Building Basement	None Detected	5% Cellulose	95% Other	Black, Yellow
10018043_0045	mastic; bag labeled as 1-C				Non-Fibrous Homogeneous Dissolved, Crushed
S0002A - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black Streaks, Loc:6, Main Building Basement	None Detected		100% Other	Gray
10018043_0004	tile				Non-Fibrous Homogeneous Crushed
S0002A - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black Streaks, Loc:6, Main Building Basement	None Detected	5% Cellulose	95% Other	Black
10018043_0005	mastic				Non-Fibrous Homogeneous Dissolved

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 heterogeneous 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%.

Lachlan Krenz (71)

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: 10018043

Analysis: PLM

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0002A - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black Streaks, Loc:6, Main Building Basement	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0046	tile; bag labeled as 2-B				Crushed
S0002A - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black Streaks, Loc:6, Main Building Basement	None Detected	5% Cellulose	95% Other	Black Non-Fibrous Homogeneous
10018043_0047	mastic; bag labeled as 2-B				Dissolved
S0002B - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black Streaks, Loc:6, Main Building Basement	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0006	tile-ashed; bag labeled as 2-C				Ashed
S0002B - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black Streaks, Loc:6, Main Building Basement	None Detected	5% Cellulose	95% Other	Black Non-Fibrous Homogeneous
10018043_0048	mastic; bag labeled as 2-C				Dissolved
S0003A - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Pink With White Fleck, Loc:19, ACLF Lounge Med Room	None Detected		100% Other	Pink Non-Fibrous Homogeneous
10018043_0007	tile				Crushed
S0003A - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Pink With White Fleck, Loc:19, ACLF Lounge Med Room	None Detected	5% Cellulose	95% Other	Black Non-Fibrous Homogeneous
10018043_0049	mastic				Dissolved
S0003B - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Pink With White Fleck, Loc:1, Main Building Ground Floor	None Detected		100% Other	Pink Non-Fibrous Homogeneous
10018043_0008	tile				Crushed
S0003B - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Pink With White Fleck, Loc:1, Main Building Ground Floor	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0050	mastic				Dissolved

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Lachlan Krenz (71)

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: 10018043

Analysis: PLM

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0003C - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Pink With White Fleck, Loc:2, Special Care Ground Floor	None Detected		100% Other	Pink Non-Fibrous Homogeneous
10018043_0009	tile - ashed				Ashed
S0003C - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Pink With White Fleck, Loc:2, Special Care Ground Floor	None Detected	5% Cellulose	95% Other	Black Non-Fibrous Homogeneous
10018043_0051	mastic				Dissolved
S0004A	Wall, Drywall And Joint Compound, Loc:17, ACLF Basement	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0010					Crushed
S0004B	Wall, Drywall And Joint Compound, Loc:17, ACLF Basement	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0011					Crushed
S0004C	Wall, Drywall And Joint Compound, Loc:17, ACLF Basement	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0012					Crushed
S0004D	Wall, Drywall And Joint Compound, Loc:16, ACLF Lower Floor	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0013					Crushed
S0004E	Wall, Drywall And Joint Compound, Loc:16, ACLF Lower Floor	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0014					Crushed
S0005A	Wall, Texture Coat, Loc:17, ACLF Basement	3% Chrysotile		97% Other	White Non-Fibrous Homogeneous
10018043_0015					Crushed

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Analyst

Approved Signatory

Scientific Analytical Institute, Inc. 4604 Dundas Dr. Greensboro, NC 27407 (336) 292-3888



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: 10018043

Analysis: PLM

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0005B	Wall,Texture Coat,Loc:17,ACLF Basement	Not Analyzed			
10018043_0016					
S0005C	Wall,Texture Coat,Loc:17,ACLF Basement	Not Analyzed			
10018043_0017					
S0005D	Wall,Texture Coat,Loc:16,ACLF Lower Floor	Not Analyzed			
10018043_0018					
S0005E	Wall,Texture Coat,Loc:16,ACLF Lower Floor	Not Analyzed			
10018043_0019					
S0006A - A	Wall,Plaster,Loc:23,House	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0020	finish				Crushed
S0006A - B	Wall,Plaster,Loc:23,House	None Detected		100% Other	Gray Non-Fibrous Heterogeneous
10018043_0052	base				Crushed
S0006B - A	Wall,Plaster,Loc:23,House	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0021	finish				Crushed
S0006B - B	Wall,Plaster,Loc:23,House	None Detected		100% Other	Gray Non-Fibrous Heterogeneous
10018043_0053	base				Crushed

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Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and
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Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10018043

Analysis: PLM

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0006C - A	Wall,Plaster,Loc:23,House	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0022	finish				Crushed
S0006C - B	Wall,Plaster,Loc:23,House	None Detected		100% Other	Gray Non-Fibrous Heterogeneous
10018043_0054	base				Crushed
S0006D - A	Wall,Plaster,Loc:23,House	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0023	finish				Crushed
S0006D - B	Wall,Plaster,Loc:23,House	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0055	base				Crushed
S0006E - A	Wall,Plaster,Loc:23,House	None Detected		100% Other	White Non-Fibrous Homogeneous
10018043_0024	finish				Crushed
S0006E - B	Wall,Plaster,Loc:23,House	None Detected		100% Other	Gray Non-Fibrous Heterogeneous
10018043_0056	base				Crushed
S0007A	Floor,Vinyl Floor Tile And Mastic,9x9 Black With White Spots,Loc:23,House	5% Chrysotile		95% Other	Black Non-Fibrous Homogeneous
10018043_0025	tile w/inseparable mastic				Dissolved, Crushed
S0007B	Floor,Vinyl Floor Tile And Mastic,9x9 Black With White Spots,Loc:23,House	Not Analyzed			
10018043_0026	tile w/inseparable mastic				

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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: 10018043

Analysis: PLM

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0007C	Floor, Vinyl Floor Tile And Mastic, 9x9 Black With White Spots, Loc:23, House	Not Analyzed			
10018043_0027	tile w/inseparable mastic				
S0008A - A	Floor, Vinyl Floor Tile And Mastic, 12x12 White With Black Streaks, Loc:22, Apartment	2% Chrysotile		98% Other	White Non-Fibrous Homogeneous
10018043_0028	tile				Crushed
S0008A - B	Floor, Vinyl Floor Tile And Mastic, 12x12 White With Black Streaks, Loc:22, Apartment	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0057	mastic				Dissolved
S0008B - A	Floor, Vinyl Floor Tile And Mastic, 12x12 White With Black Streaks, Loc:22, Apartment	Not Analyzed			
10018043_0029	tile				
S0008B - B	Floor, Vinyl Floor Tile And Mastic, 12x12 White With Black Streaks, Loc:22, Apartment	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0058	mastic				Dissolved
S0008C - A	Floor, Vinyl Floor Tile And Mastic, 12x12 White With Black Streaks, Loc:22, Apartment	Not Analyzed			
10018043_0030	tile				
S0008C - B	Floor, Vinyl Floor Tile And Mastic, 12x12 White With Black Streaks, Loc:22, Apartment	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0059	mastic				Dissolved
S0009A - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black And White Fleck, Loc:1, Main Building G	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0031	tile				Crushed

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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
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Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10018043

Analysis: PLM

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0009A - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black And White Fleck, Loc: 1, Main Building G	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0060	mastic				Dissolved
S0009B - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black And White Fleck, Loc: 1, Main Building G	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0032	tile				Crushed
S0009B - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black And White Fleck, Loc: 1, Main Building G	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0061	mastic				Dissolved
S0009C - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black And White Fleck, Loc: 1, Main Building G	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0033	tile-ashed				Dissolved
S0009C - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Grey With Black And White Fleck, Loc: 1, Main Building G	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0062	mastic				Ashed
S0010A - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Brown With White, Light Brown, Dark Brown Fleck, Loc: 1, Main Bui	None Detected		100% Other	Beige Non-Fibrous Homogeneous
10018043_0034	tile				Crushed
S0010A - B	Floor, Vinyl Floor Tile And Mastic, 12x12 Brown With White, Light Brown, Dark Brown Fleck, Loc: 1, Main Bui	None Detected		100% Other	Yellow Non-Fibrous Homogeneous
10018043_0063	mastic				Ashed
S0010B - A	Floor, Vinyl Floor Tile And Mastic, 12x12 Brown With White, Light Brown, Dark Brown Fleck, Loc: 1, Main Bui	None Detected		100% Other	Beige Non-Fibrous Homogeneous
10018043_0035	tile				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 heterogeneous 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%.

Lachlan Krenz (71)

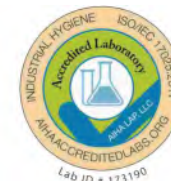
Analyst

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: 10018043

Analysis: PLM

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0010B - B	Floor,Vinyl Floor Tile And Mastic,12x12 Brown With White, Light Brown, Dark Brown Fleck,Loc:1,Main Bui	None Detected		100% Other	Yellow Non-Fibrous Homogeneous
10018043_0064	mastic				Ashed
S0010C - A	Floor,Vinyl Floor Tile And Mastic,12x12 Brown With White, Light Brown, Dark Brown Fleck,Loc:1,Main Bui	None Detected		100% Other	Beige Non-Fibrous Homogeneous
10018043_0036	tile-ashed				Ashed
S0010C - B	Floor,Vinyl Floor Tile And Mastic,12x12 Brown With White, Light Brown, Dark Brown Fleck,Loc:1,Main Bui	None Detected		100% Other	Yellow Non-Fibrous Homogeneous
10018043_0065	mastic				Ashed
S0011A - A	Floor,Vinyl Floor Tile And Mastic,Ceramic Tile Look Style Peel And Stick,Loc:2,Special Care Gro	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0037	self stick tile				Ashed
S0011A - B	Floor,Vinyl Floor Tile And Mastic,Ceramic Tile Look Style Peel And Stick,Loc:2,Special Care Gro	None Detected		100% Other	Beige Non-Fibrous Homogeneous
10018043_0066	mastic				Ashed
S0011B - A	Floor,Vinyl Floor Tile And Mastic,Ceramic Tile Look Style Peel And Stick,Loc:2,Special Care Gro	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0038	self stick tile				Ashed
S0011B - B	Floor,Vinyl Floor Tile And Mastic,Ceramic Tile Look Style Peel And Stick,Loc:2,Special Care Gro	None Detected		100% Other	Beige Non-Fibrous Homogeneous
10018043_0067	mastic				Ashed
S0011C - A	Floor,Vinyl Floor Tile And Mastic,Ceramic Tile Look Style Peel And Stick,Loc:2,Special Care Gro	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0039	self stick tile				Ashed

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 heterogeneous 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%.

Lachlan Krenz (71)

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: 10018043

Analysis: PLM

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0011C - B	Floor,Vinyl Floor Tile And Mastic,Ceramic Tile Look Style Peel And Stick,Loc:2,Special Care Gro	None Detected		100% Other	Beige Non-Fibrous Homogeneous
10018043_0068	mastic				Ashed
S0012A - A	Floor,Vinyl Floor Tile And Mastic,12x12 Blue With White And Grey Streak,Loc:3,Main Building	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0040	tile				Crushed
S0012A - B	Floor,Vinyl Floor Tile And Mastic,12x12 Blue With White And Grey Streak,Loc:3,Main Building	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0069	mastic				Crushed
S0012B - A	Floor,Vinyl Floor Tile And Mastic,12x12 Blue With White And Grey Streak,Loc:3,Main Building	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0041	tile				Crushed
S0012B - B	Floor,Vinyl Floor Tile And Mastic,12x12 Blue With White And Grey Streak,Loc:3,Main Building	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0070	mastic				Dissolved
S0012C - A	Floor,Vinyl Floor Tile And Mastic,12x12 Blue With White And Grey Streak,Loc:3,Main Building	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018043_0042	tile-ashed				Ashed
S0012C - B	Floor,Vinyl Floor Tile And Mastic,12x12 Blue With White And Grey Streak,Loc:3,Main Building	None Detected		100% Other	Black Non-Fibrous Homogeneous
10018043_0071	mastic				Dissolved

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%.

Lachlan Krenz (71)

Analyst

Approved Signatory

10018043

Version 1-10-2012

Client:	Pinchin Ltd.	Instructions: Use Column "B" for your contact info. To See an Example Click the Bottom Example Tab. 42 Begin Samples with a "cc" 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@sallab.com
Contact:	Justin Appleby / Leslie Heywood		
Address:			
Phone:			
Fax:			
Email:	jappleby@pinchin.com heywood@pinchin.com		
Project:	Stop positive on all samples. Perform ashing on third vinyl floor tile / first two are ND.		
Client Notes:			
P.O. #:	321956-000		
Date Submitted:	03-06-2023		
Analysis:	PLM BULK EPA 600		
Turnaround Time:	Regular 5 Days		

Sample Number	Data 1 (Lab use only)	Sample Description	Data 2 (Lab use only)
42			
S0001A		Floor,Vinyl Floor Tile And Mastic,12x12 Beige With Orange Streaks,Loc:8,Main Building Basement	
S0001A		Floor,Vinyl Floor Tile And Mastic,12x12 Beige With Orange Streaks,Loc:8,Main Building Basement	
S0001B		Floor,Vinyl Floor Tile And Mastic,12x12 Beige With Orange Streaks,Loc:8,Main Building Basement	
S0002A		Floor,Vinyl Floor Tile And Mastic,12x12 Grey With Black Streaks,Loc:8,Main Building Basement	
S0002A		Floor,Vinyl Floor Tile And Mastic,12x12 Grey With Black Streaks,Loc:8,Main Building Basement	
S0002B		Floor,Vinyl Floor Tile And Mastic,12x12 Grey With Black Streaks,Loc:8,Main Building Basement	
S0003A		Floor,Vinyl Floor Tile And Mastic,12x12 Pink With White Fleck,Loc:19,ACLF Lounge Med Room	
S0003B		Floor,Vinyl Floor Tile And Mastic,12x12 Pink With White Fleck,Loc:1,Main Building Ground Floor	
S0003C		Floor,Vinyl Floor Tile And Mastic,12x12 Pink With White Fleck,Loc:2,Special Care Ground Floor	
S0004A		Wall,Drywall And Joint Compound,Loc:17,ACLF Basement	
S0004B		Wall,Drywall And Joint Compound,Loc:17,ACLF Basement	
S0004C		Wall,Drywall And Joint Compound,Loc:17,ACLF Basement	
S0004D		Wall,Drywall And Joint Compound,Loc:16,ACLF Lower Floor	
S0004E		Wall,Drywall And Joint Compound,Loc:16,ACLF Lower Floor	
S0005A		Wall Texture Coat,Loc:17,ACLF Basement	
S0005B		Wall Texture Coat,Loc:17,ACLF Basement	
S0005C		Wall Texture Coat,Loc:17,ACLF Basement	
S0005D		Wall Texture Coat,Loc:16,ACLF Lower Floor	
S0005E		Wall Texture Coat,Loc:16,ACLF Lower Floor	
S0006A		Wall,Plaster,Loc:23,House	
S0006B		Wall,Plaster,Loc:23,House	
S0006C		Wall,Plaster,Loc:23,House	
S0006D		Wall,Plaster,Loc:23,House	
S0006E		Wall,Plaster,Loc:23,House	
S0007A		Floor,Vinyl Floor Tile And Mastic,8x8 Black With White Spots,Loc:23,House	
S0007B		Floor,Vinyl Floor Tile And Mastic,8x8 Black With White Spots,Loc:23,House	
S0007C		Floor,Vinyl Floor Tile And Mastic,8x8 Black With White Spots,Loc:23,House	
S0008A		Floor,Vinyl Floor Tile And Mastic,12x12 White With Black Streaks,Loc:22,Apartment	
S0008B		Floor,Vinyl Floor Tile And Mastic,12x12 White With Black Streaks,Loc:22,Apartment	
S0008C		Floor,Vinyl Floor Tile And Mastic,12x12 White With Black Streaks,Loc:22,Apartment	
S0009A		Floor,Vinyl Floor Tile And Mastic,12x12 Grey With Black And White Fleck,Loc:3,Main Building Ground Floor	
S0009B		Floor,Vinyl Floor Tile And Mastic,12x12 Grey With Black And White Fleck,Loc:3,Main Building Ground Floor	
S0009C		Floor,Vinyl Floor Tile And Mastic,12x12 Grey With Black And White Fleck,Loc:1,Main Building Ground Floor	
S0010A		Floor,Vinyl Floor Tile And Mastic,12x12 Brown With White, Light Brown, Dark Brown Fleck,Loc:1,Main Building Ground Floor	
S0010B		Floor,Vinyl Floor Tile And Mastic,12x12 Brown With White, Light Brown, Dark Brown Fleck,Loc:1,Main Building Ground Floor	
S0010C		Floor,Vinyl Floor Tile And Mastic,12x12 Brown With White, Light Brown, Dark Brown Fleck,Loc:1,Main Building Ground Floor	
S0011A		Floor,Vinyl Floor Tile And Mastic,Ceramic Tile Look Style Peel And Stick,Loc:2,Special Care Ground Floor	
S0011B		Floor,Vinyl Floor Tile And Mastic,Ceramic Tile Look Style Peel And Stick,Loc:2,Special Care Ground Floor	
S0011C		Floor,Vinyl Floor Tile And Mastic,Ceramic Tile Look Style Peel And Stick,Loc:2,Special Care Ground Floor	
S0012A		Floor,Vinyl Floor Tile And Mastic,12x12 Blue With White And Grey Streak,Loc:3,Main Building Dining Offices	
S0012B		Floor,Vinyl Floor Tile And Mastic,12x12 Blue With White And Grey Streak,Loc:3,Main Building Dining Offices	
S0012C		Floor,Vinyl Floor Tile And Mastic,12x12 Blue With White And Grey Streak,Loc:3,Main Building Dining Offices	

Accepted ☒Rejected ☐

CS 3/7. 10:30 AM



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: 10018758

Analysis: PLM

Date Received: 03/15/2023

Date Reported: 03/22/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0013A - A	Floor, Vinyl Sheet Flooring, Beige Peel And Stick, Loc:2, Special Care Ground Floor	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018758_0001	vinyl sheet flooring				Ashed
S0013A - B	Floor, Vinyl Sheet Flooring, Beige Peel And Stick, Loc:2, Special Care Ground Floor	None Detected		100% Other	Yellow Non-Fibrous Homogeneous
10018758_0017	mastic				Ashed
S0013B - A	Floor, Vinyl Sheet Flooring, Beige Peel And Stick, Loc:2, Special Care Ground Floor	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018758_0002	vinyl sheet flooring				Ashed
S0013B - B	Floor, Vinyl Sheet Flooring, Beige Peel And Stick, Loc:2, Special Care Ground Floor	None Detected		100% Other	Yellow Non-Fibrous Homogeneous
10018758_0018	mastic				Ashed
S0013C - A	Floor, Vinyl Sheet Flooring, Beige Peel And Stick, Loc:2, Special Care Ground Floor	None Detected		100% Other	Gray Non-Fibrous Homogeneous
10018758_0003	vinyl sheet flooring - ashed				Ashed
S0013C - B	Floor, Vinyl Sheet Flooring, Beige Peel And Stick, Loc:2, Special Care Ground Floor	None Detected		100% Other	Yellow Non-Fibrous Homogeneous
10018758_0019	mastic				Ashed
S0014A	Floor, Vinyl Sheet Flooring, Red And Brown Peel And Stick, Loc:2, Special Care Ground Floor	20% Chrysotile	5% Cellulose	75% Other	Tan, Red Fibrous Homogeneous
10018758_0004	inseparable layers				Ashed
S0014A	Floor, Vinyl Sheet Flooring, Red And Brown Peel And Stick, Loc:2, Special Care Ground Floor	Not Analyzed			
10018758_0005	coc mislabeled 14-A, bag labeled 14-B				

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Nicholas Pallares (19)

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: 10018758

Analysis: PLM

Date Received: 03/15/2023

Date Reported: 03/22/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0014A	Floor,Vinyl Sheet Flooring,Red And Brown Peel And Stick,Loc:2,Special Care Ground Floor	Not Analyzed			
10018758_0006	coc mislabeled 14-A, bag labeled 14-C				
S0015A	Ceiling,Texture Coat,Loc:22,Apartment	2% Chrysotile	3% Cellulose	95% Other	White Fibrous Homogeneous
10018758_0007					Dissolved
S0015B	Ceiling,Texture Coat,Loc:22,Apartment	Not Analyzed			
10018758_0008					
S0015C	Ceiling,Texture Coat,Loc:22,Apartment	Not Analyzed			
10018758_0009					
S0015D	Ceiling,Texture Coat,Loc:22,Apartment	Not Analyzed			
10018758_0010					
S0015E	Ceiling,Texture Coat,Loc:22,Apartment	Not Analyzed			
10018758_0011					
S0016A	Ceiling,Drywall And Joint Compound,Loc:22,Apartment	3% Chrysotile	2% Cellulose	95% Other	White, Tan Fibrous Homogeneous
10018758_0012					Dissolved
S0016B	Ceiling,Drywall And Joint Compound,Loc:22,Apartment	Not Analyzed			
10018758_0013					

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Nicholas Pallares (19)

Analyst

Approved Signatory

Scientific Analytical Institute, Inc. 4604 Dundas Dr. Greensboro, NC 27407 (336) 292-3888



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: 10018758

Analysis: PLM

Date Received: 03/15/2023

Date Reported: 03/22/2023

Project:

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
S0016C	Ceiling,Drywall And Joint Compound,Loc:22,Apartment	Not Analyzed			
10018758_0014					
S0016D	Ceiling,Drywall And Joint Compound,Loc:22,Apartment	Not Analyzed			
10018758_0015					
S0016E	Ceiling,Drywall And Joint Compound,Loc:22,Apartment	Not Analyzed			
10018758_0016					

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%.

Nicholas Pallares (19)

Analyst

Approved Signatory

Scientific Analytical Institute, Inc. 4604 Dundas Dr. Greensboro, NC 27407 (336) 292-3888

10018758

Version 1-15-2012

Client: Pinchin Ltd. Contact: Justin Appleby / Leslie Heywood Address: Phone: Fax: Email: appleby@pinchin.com heywood@pinchin.com	Instructions: Use Column "B" for your contact info To See an Example Click the bottom Example Tab. 16 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: iab@sailab.com
Project: Stop positive on all samples. Perform ashing on third vinyl floor (ie 1 first two are NID).		
Client Notes:		
P.O. #: 321956-002 Date Submitted: 03-14-2023		
Analysis: PLM BULK EPA 600 TurnAroundTime: Regular 5 days		

<< S0013A S0013B S0013C S0014A S0014A S0015A S0015B S0015C S0015D S0015E S0016A S0016B S0016C S0016D S0016E >>	Floor,Vinyl Sheet Flooring,Beige Peel And Stick,Loc:2,Special Care Ground Floor Floor,Vinyl Sheet Flooring,Beige Peel And Stick,Loc:2,Special Care Ground Floor Floor,Vinyl Sheet Flooring,Beige Peel And Stick,Loc:2,Special Care Ground Floor Floor,Vinyl Sheet Flooring,Red And Brown Peel And Stick,Loc:2,Special Care Ground Floor Floor,Vinyl Sheet Flooring,Red And Brown Peel And Stick,Loc:2,Special Care Ground Floor Floor,Vinyl Sheet Flooring,Red And Brown Peel And Stick,Loc:2,Special Care Ground Floor Ceiling,Texture Coat,Loc:22,Apartment Ceiling,Texture Coat,Loc:22,Apartment Ceiling,Texture Coat,Loc:22,Apartment Ceiling,Texture Coat,Loc:22,Apartment Ceiling,Drywall And Joint Compound,Loc:22,Apartment Ceiling,Drywall And Joint Compound,Loc:22,Apartment Ceiling,Drywall And Joint Compound,Loc:22,Apartment Ceiling,Drywall And Joint Compound,Loc:22,Apartment Ceiling,Drywall And Joint Compound,Loc:22,Apartment

John 3/15
10:30am

Accepted ☐Rejected ☐

APPENDIX II-B
Lead Analytical Certificates



THE REGIONAL MUNICIPALITY OF HALTON

Analysis for Lead Concentration in Paint Chips

by Flame Atomic Absorption Spectroscopy
EPA SW-846 3050B/6010C/7000B



Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10018046

Analysis: PBP

Date Received: 03/07/2023

Date Reported: 03/14/2023

Project:

Sample ID	Description	Mass (g)	Concentration (ppm)	Concentration (% by weight)
Lab Sample ID	Lab Notes			
L0001	Wall, Masonry, Pink Concrete Block, Loc:6, Main Building Basement	0.1098	<36	<0.0036%
10018046_0001				
L0002	Wall, Masonry, Green Concrete Block, Loc:6, Main Building Basement	0.0740	68	0.0068%
10018046_0002				
L0003	Wall, Drywall And Joint Compound, White, Loc:19, ACLF Lounge Med Room	0.1147	39	0.0039%
10018046_0003				
L0004	Wall, Drywall And Joint Compound, Pink, Loc:19, ACLF Lounge Med Room	0.1510	<26	<0.0026%
10018046_0004				
L0005	Wall, Drywall And Joint Compound, Grey, Loc:4, Special Care Second Floor	0.0969	<41	<0.0041%
10018046_0005				
L0006	Wall, Drywall And Joint Compound, Yellow, Loc:23, House	0.0576	<69	<0.0069%
10018046_0006				
L0007	Wall, Drywall And Joint Compound, Blue, Loc:2, Special Care Ground Floor	0.0596	<67	<0.0067%
10018046_0007				
L0008	Wall, Drywall And Joint Compound, Beige, Loc:1, Main Building Ground Floor	0.0589	<68	<0.0068%
10018046_0008				

Disclaimer: Unless otherwise noted blank sample correction was not performed on analytical results. Scientific Analytical Institute participates in the AIHA ELPAT program. ELPAT Laboratory ID: 173190. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. Analytical uncertainty available upon request. The quality control samples run with the samples in this report have passed all EPA required specifications unless otherwise noted. RL: (Report Limit for an undiluted 50ml sample is 4µg Total Pb).

Athena Summa (8)

Nathaniel J. Durham

Analyst

Approved Signatory

10018646
Version 1-15-2012

Client:	Pinchin Ltd.	Instructions: Use Column "B" for your contact info. To See an Example Click the bottom Example Tab. 10 Begin Samples with a "<<" above the first sample and end with a ">>" below the last sample. Only Enter your data on the first sheet "Sheet 1" 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 Appieby / Leslie Heywood		
Address:			
Phone:			
Fax:			
Email:	jappleby@pinchin.com heywood@pinchin.com		
Project:			
Client Notes:			
P.O. #:	321956000		
Data Submitted:	03-06-2023		
Analysis:	Paint Chips Flame AA		
TurnAroundTime:	5 Days Regular		

Sample Number	Data 1 (Lab use only)	Sample Description	Data 2 (Lab use only)
<<			
L0001		Wall, Masonry, Pink Concrete Block, Loc:5, Main Building Basement	
L0002		Wall, Masonry, Green Concrete Block, Loc:5, Main Building Basement	
L0003		Wall, Drywall And Joint Compound, White, Loc:19, ACLF Lounge Med Room	
L0004		Wall, Drywall And Joint Compound, Pink, Loc:19, ACLF Lounge Med Room	
L0005		Wall, Drywall And Joint Compound, Grey, Loc:4, Special Care Second Floor	
L0006		Wall, Drywall And Joint Compound, Yellow, Loc:23, House	
L0007		Wall, Drywall And Joint Compound, Blue, Loc:2, Special Care Ground Floor	
L0008		Wall, Drywall And Joint Compound, Beige, Loc:1, Main Building Ground Floor	
>>			

Accepted ☒Rejected ☐

CS 3/7, 10:30 AM



THE REGIONAL MUNICIPALITY OF HALTON

Analysis for Lead Concentration in Paint Chips

by Flame Atomic Absorption Spectroscopy
EPA SW-846 3050B/6010C/7000B



Customer: Pinchin Ltd.
6-875 Main St West, Suite 200
Hamilton, ON L8S 4R9

Attn: Justin Appleby
Leslie Heywood

Lab Order ID: 10018761

Analysis: PBP

Date Received: 03/15/2023

Date Reported: 03/22/2023

Project:

Sample ID	Description	Mass (g)	Concentration (ppm)	Concentration (% by weight)
Lab Sample ID	Lab Notes			
L0011	Wall, Drywall And Joint Compound, Beige, Loc:21, Link	0.0742	<54	<0.0054%
10018761_0001				
L0012	Wall, Drywall And Joint Compound, Pink, Loc:1, Main Building Ground Floor	0.1266	<32	<0.0032%
10018761_0002				
L0012	Ceiling, Drywall And Joint Compound, Pink, Loc:1, Main Building Ground Floor	0.0513	<78	<0.0078%
10018761_0003				
L0013	Ceiling, Drywall And Joint Compound, White, Loc:3, Main Building Dining Offices	0.0633	<63	<0.0063%
10018761_0004				
L0014	Ceiling, Drywall And Joint Compound, White, Loc:22, Apartment	0.0958	<42	<0.0042%
10018761_0005				

Disclaimer: Unless otherwise noted blank sample correction was not performed on analytical results. Scientific Analytical Institute participates in the AIHA ELPAT program. ELPAT Laboratory ID: 173190. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. Analytical uncertainty available upon request. The quality control samples run with the samples in this report have passed all EPA required specifications unless otherwise noted. RL: (Report Limit for an undiluted 50ml sample is 4µg Total Pb).

Kristina Dumais (5)

Nathaniel J. Durham

Analyst

Approved Signatory

10618761

Version 1-15-2012

Client: Contact: Address: Phone: Fax: Email:	Pinchin Ltd. Justin Appleby / Leslie Heywood jappleby@pinchin.com heywood@pinchin.com	Instructions: Use Column "B" for your contact info To See an Example Click the bottom Example Tab. 16 Begin Samples with a "<<" above the first sample and end with a ">>" below the last sample. Only Enter your data on the first sheet "Sheet 1" 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
Project: Client Notes: P.O. # Date Submitted: Analysis: TurnAroundTime:	321956.002 03-14-2023 Paint Chips Flame AA <i>zy</i> 5 days Regular		

 <<
 L0011
 L0012
 L0013
 L0014
 >>

 Wall, Drywall And Joint Compound, Beige, Loc: 21, Link
 Wall, Drywall And Joint Compound, Pink, Loc: 1, Main Building Ground Floor
 Ceiling, Drywall And Joint Compound, Pink, Loc: 1, Main Building Ground Floor
 Ceiling, Drywall And Joint Compound, White, Loc: 3, Main Building Dining Offices
 Ceiling, Drywall And Joint Compound, White, Loc: 22, Apartment

John 31.5
 10:30am
Accepted ☒Rejector ☐